Science and Invention

SEPTEMBER

25 CENTS

Traveling — Straight Down

See Page 408

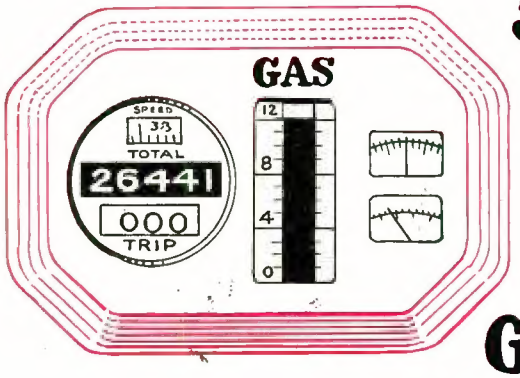
Uncle Sam's Mechanical Live-Stock Show

How to Match the Hull, Motor, and Propeller of Your Outboard

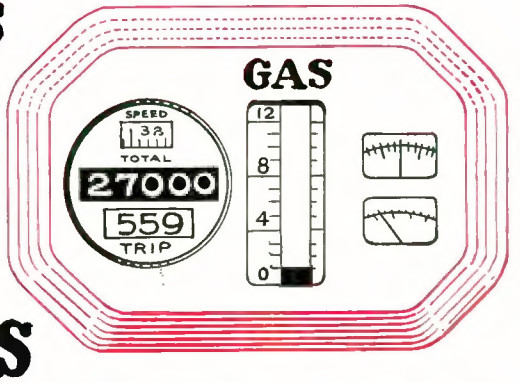
By J. Phillips Dykes, A.O.A.

How to Make: A Rock Garden — Furniture in the Mode Moderne — A Telephone Table — A Jeweled Lamp

Over the Mountains from Los Angeles



559 Miles on 11 Gallons of GAS



Think of it! FIVE HUNDRED FIFTY-NINE MILES over rough mountainous country burning only ELEVEN GALLONS OF GASOLINE. Imagine more than FIFTY MILES to the GALLON. This is what the WHIRLWIND CARBURETING DEVICE does for D. R. Gilbert, enough of a saving on just one trip to more than pay the cost of the Whirlwind.

THE WHIRLWIND SAVES MOTORISTS MILLIONS OF DOLLARS YEARLY

Whirlwind users, reporting the results of their tests, are amazed at the results they are getting. Letters keep streaming into the office telling of mileages all the way from 22 to 59 miles on a gallon, resulting in a saving of from 25 to 50% in gas bills alone.

Mark H. Estes writes: "I was making 17 miles to the gallon on my Pontiac Coupe. Today, with the Whirlwind, I am making 35 5/10 miles to the gallon. Am I glad I put it on? I'll say so!"

P. P. Goerzen writes: "I made an actual test both with and without a Whirlwind, getting 13½ miles without and 34 6/10 miles with the Whirlwind, or a gain of 21 miles to the gallon. The longer the Whirlwind is in use on the machine, the better the engine runs, has more pep and quicker starting. It makes a new engine out of an old one, and starts at the touch of the starter button."

R. J. Tulp: "The Whirlwind increased the mileage on our Ford truck from 12 to 26 miles to gallon and 25% in speed. We placed another on a Willy's Knight, and increased from 12 to 17 miles per gallon.

Arthur Grant: "I have an Oakland touring car that has been giving me 15 miles to the gallon average, but I can see a great difference with the Whirlwind, as it climbs the big hills on high and gives me better than 23 miles to the gallon of gas, which is better than 50% saving in gas."

W. A. Scott: "I had my Whirlwind for three years. Winter and summer it gives the same perfect service, instant starting, smoother running, and what I saved in gasoline these last few years has brought other luxuries which I could not have afforded previously."

Car owners all over the world are saving money every day with the Whirlwind, besides having better operating motors. Think what this means on your own car. Figure up your savings—enough for a radio—a bank account—added pleasures. Why let the Oil Companies profit by your waste. Find out about this amazing little device that will pay for itself every few weeks in gas saving alone.

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In just a few minutes the Whirlwind can be installed on any make of car, truck, or tractor. It's actually less work than changing your oil, or putting water in the battery. No drilling, tapping or changes of any kind necessary. It is guaranteed to work perfectly on any make of car, truck or tractor, large or small, new model or old model. The more you drive the more you will save.

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Whirlwind men are making big profits supplying this fast-selling device that car owners cannot afford to be without. Good territory is still open. Free sample offer to workers. Full particulars sent on request. Just check the coupon.

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999-324-A Third Street Milwaukee, Wisc.

GUARANTEE

No matter what kind of a car you have—no matter how big a gas eater it is—the Whirlwind will save you money. We absolutely guarantee that the Whirlwind will more than save its cost in gasoline alone within thirty days, or the trial will cost you nothing. We invite you to test it at our risk and expense. You are to be the sole judge.

FREE OFFER COUPON

WHIRLWIND MANUFACTURING CO.
999-324-A Third Street, Milwaukee, Wisc.

Gentlemen: You may send me full particulars of your Whirlwind Carbureting device and tell me how I can get one free. This does not obligate me in any way whatever.

Name .....

Address .....

City .....

County ..... State .....

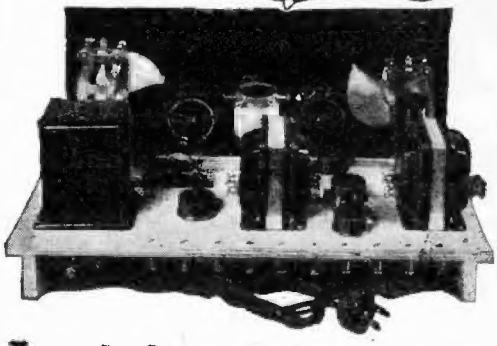
☐ Check here if you are interested in full or part time salesmen position.

I will train you at home to fill a BIG PAY Radio Job!

I will give You my new 8 OUTFITS of RADIO PARTS for a home Experimental Laboratory

You can build over 100 circuits with these outfits. You build and experiment with the circuits used in Crosley, Atwater - Kent, Eveready, Majestic, Zenith, and other popular sets. You learn how these sets work, why they work, how to make them work. This makes learning at home easy, fascinating, practical.

Back view of 5 tube Screen Grid A. C. tuned Radio frequency set—only one of many circuits you can build with my outfits.



I am doubling and tripling the salaries of many in one year and less Find out about this quick way to BIGGER PAY

Radio Needs Trained Men

FILL OUT AND MAIL THIS COUPON TODAY

J. E. SMITH, President,
National Radio Institute, Dept. OKS
Washington, D. C.

Dear Mr. Smith: Send me your book. This request does not obligate me.

Name .....

Address .....

City ..... State .....

Here's Proof

$100 a week

"My earnings in Radio are many times greater than I ever expected they would be when I enrolled. They seldom fall under $100 a week. If your course cost four or five times more I would still consider it a good investment."

E. E. WINBORNE
1414 W. 48th St.,
Norfolk, Va.

Jumped from $35 to $100 a week

"Before I entered Radio I was making $35 a week. Last week I earned $110 servicing and selling Radios. I owe my success to N. R. I. You started me off on the right foot."

J. A. VAUGHN
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St. Louis, Mo.

$500 extra in 6 months

"In looking over my records I find I made $500 from January to May in my spare time. My best week brought me $107. I have only one regret regarding your course—I should have taken it long ago."

HOYT MOORE
R. R. 3, Box 919,
Indianapolis, Ind.,

If you are earning a penny less than $50 a week, send for my book of information on the opportunities in Radio. It is free. Clip the coupon NOW. Why be satisfied with $25, $30 or $40 a week for longer than the short time it takes to get ready for Radio.

Radio's growth opening hundreds of $50, $75, $100 a week jobs every year

In about ten years Radio has grown from a $2,000,000 to a $1,000,000,000 industry. Over 300,000 jobs have been created. Hundreds more are being opened every year by its continued growth. Men and young men with the right training—the kind of training I give you—are needed continually.

You have many jobs to choose from

Broadcasting stations use engineers, operators, station managers and pay $1,800 to $5,000 a year. Manufacturers continually need testers, inspectors, foremen, engineers, service men, buyers, for jobs paying up to $15,000 a year. Shipping companies use hundreds of Radio operators, give them world wide travel at practically no expense and a salary of $85 to $200 a month. Dealers and jobbers employ service men, salesmen, buyers, managers, and pay $30 to $100 a week. There are many other opportunities too. My book tells you about them.

So many opportunities many N. R. I. men make $5 to $25 a week while learning

The day you enroll with me I'll show you how to do 10 jobs, common in most every neighborhood, for spare time money. Throughout your course I send you information on servicing popular makes of sets; I give you the plans and ideas that are making $200 to $1,000 for hundreds of N. R. I. students in their spare time while studying.

Talking Movies, Television, Wired Radio included

Radio principles as used in Talking Movies, Television and home Television experiments, Wired Radio, Radio's use in Aviation, are all given. I am so sure that I can train you satisfactorily that I will agree in writing to refund every penny of your tuition if you are not satisfied with my Lessons and Instruction Service upon completing.

64-page book of information FREE

Get your copy today. It tells you where Radio's good jobs are, what they pay, tells you about my course, what others who have taken it are doing and making. Find out what Radio offers you, without the slightest obligation. ACT NOW.

J. E. SMITH, President
National Radio Institute Dept., OKS
Washington, D. C.

Our Own Home

Pioneer and World's Largest Home-Study Radio training organization devoted entirely to training men and young men for good jobs in the Radio industry. Our growth has paralleled Radio's growth. We occupy three hundred times as much floor space now as we did when organized in 1914.

Lifetime Employment Service to all Graduates

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R. T. I. QUALIFIES YOU TO MAKE MONEY AND ITS SERVICE KEEPS YOU UP-TO-THE-MINUTE ON THE NEWEST DEVELOPMENTS IN RADIO, TELEVISION, AND TALKING PICTURES **R. T. I.**

$60 to $125.00 A WEEK
Radio Operator

$8 to $15.00 A DAY
Servicing and Repairing Radio Sets

$5000.00 A YEAR AND UP
Radio Engineer for Broadcasting Station

$85.00 A WEEK
Installing and Repairing Talking Picture Equipment

GOOD JOBS *Right at Your Finger Tips*

WHEN YOU ARE R.T.I. TRAINED IN

RADIO-TELEVISION-*Talking Pictures*

BIG PAY JOBS! SPARE TIME PROFITS! A FINE BUSINESS OF YOUR OWN! They're all open to you and other live wire men who answer the call of RADIO. The fastest growing industry in the world needs more trained men. And now come Television and Talking Movies—the magic sisters of Radio. Will you answer this call? Will you get ready for a big pay job NOW and step into a BIGGER ONE later on? You can do it EASILY now.

R. T. I. Home Training Puts You In This Big Money Field

Radio alone, pays over 200 MILLION DOLLARS a year in wages in Broadcasting, Manufacturing, Sales, Service, Commercial Stations and on board the big sea going ships, and many more men are needed. Television and Talking Movies open up other vast fields of money-making opportunities for ambitious men. Get into this great business that is live, new and up-to-date, where trained service men easily earn $40 to $50 per week, and trained men with experience can make $75 a week, and up.

Easy To Learn At Home—In Spare Time

Learning Radio the R. T. I. way with F. H. Schnell, the "Ace of Radio" behind you is EASY, INTERESTING, really FUN. Only a few spare hours are needed and lack of education or experience won't bother you a bit. We furnish all necessary testing and working apparatus and start you off on practical work you'll enjoy—you learn to do the jobs that pay real money and which are going begging now for want of competent men to fill them.

Amazingly Quick Results

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FRED H. SCHNELL
Chief of R. T. I. Staff

Twenty years of Radio Experience. First to establish two-way amateur communication with Europe. Former Traffic Manager of American Radio Relay League. Lieut. Commander U.S.N.R. Inventor and Designer Radio Apparatus. Consultant Radio Engineer. Now in charge of R. T. I. Radio Training—and you will like his friendly manner of helping you realize your ambition.

is kept right up-to-date with last minute information. In a few weeks you can be doing actual Radio work, making enough EXTRA MONEY to more than pay for your training. In a few short months you can be all through—ready to step into a good paying job or start a business of your own. A BIG JOB—BIG MONEY—A BIG FUTURE. There is no other business in the world like it.

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Don't waste a minute. Find out what the great Radio Industry, which has grown faster than the Automobile and Motion Picture business, has to offer you. Find out what other men are earning. SEE HOW EASILY YOU CAN GET STARTED. Get the facts about Radio, Television and the Talking Pictures, first hand, in the big R. T. I. FREE BOOK. Learn what this R. T. I. "Three in One" Home Training can do for you. Mail the Coupon for FREE BOOK NOW.

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Earned $500 Extra Money in Two Months

Your radio course has enabled me to earn over $500 in two months' spare time work. Understand that this is all spare time work, as I have a permanent position with my father in our store. I give you all the credit for the above and as I said before, I wish to finish the entire course as soon as I can.—Your student, J. NOFFSINGER, Greenville, Ky. R 1, Box 37.

Salary Raised 331-3% Since Enrolling

You may be interested to know that I am now Radio Service Manager for the H. N. Knight Supply Co. who are distributors for Eveready Radio Receivers in the State of Oklahoma, and Texas Panhandle, with an increase in salary of about 33 1-3%, since I enrolled with your school.

Thanking you for your interest you have shown in me, and your wonderful course, I am, EARL P. GORDON, 618 East 6th St., Oklahoma City, Okla.

Makes $25 a Day

Haven't forgotten you. How could I when I make as high as $25.00 per day and have made $600.00 in two months from Radio work. That's not so bad when I'm only 19 and in a small town. I just looked over the catalog you sent me before I enrolled, and you did about all you said you would and about as much more.—FLOYD KNISELY, R. F. D. 2, Box 91, St. Joe, Ind.

R. T. I. TRAINS YOU AT HOME FOR A GOOD JOB OR A PROFITABLE PART TIME OR FULL TIME BUSINESS OF YOUR OWN

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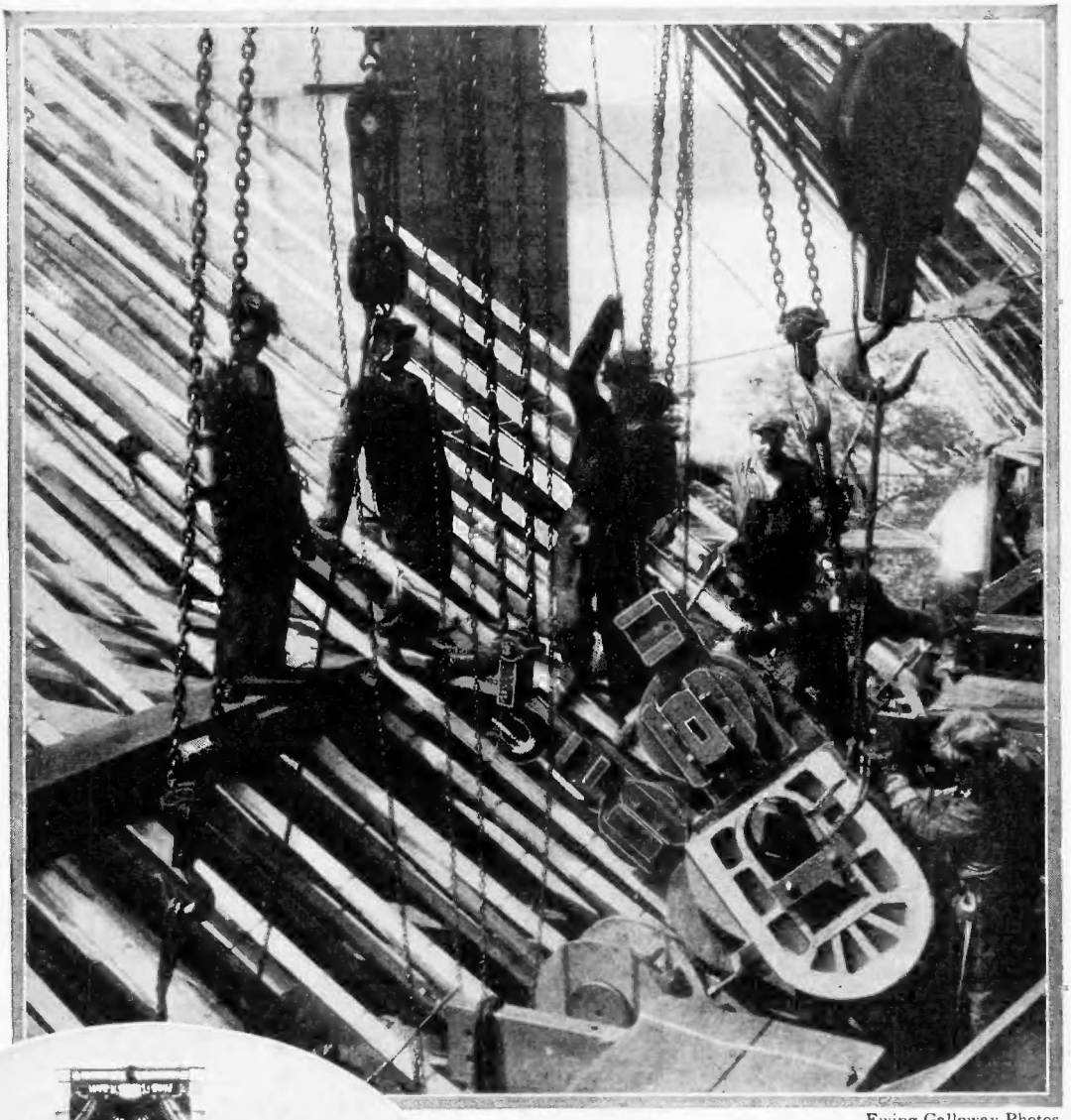
Send me Free and prepaid your BIG BOOK "Tune In On Big Pay" and full details of your three-in-one Home Training (without obligating me in any way).

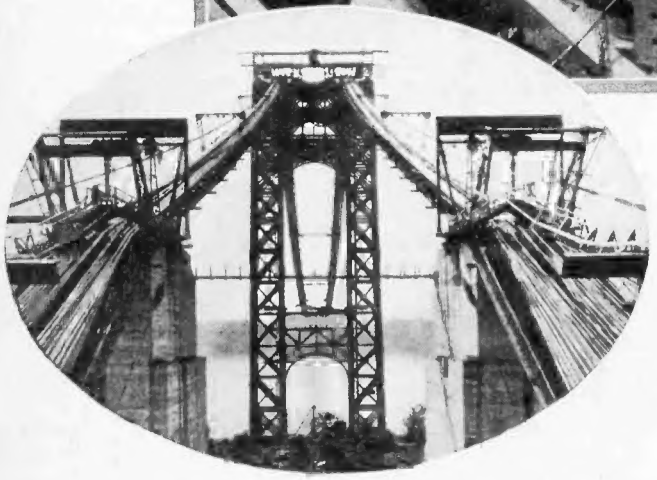
Name.....

Address.....

City..... State.....

Reaching *for the* Palisades





Ewing Galloway Photos

Bridges and tunnels to Brooklyn, Jersey, Queens. . . . And now Manhattan flings strands of steel directly west across the Hudson and anchors them in the Palisades, historic highlands extending for unbroken miles along the Jersey shore. . . . The new Hudson Bridge will be the greatest suspension bridge in the world, and when completed will support a great motor highway for traffic now largely crossing by ferry. Its span is 3,500 feet and the cost of building it will be $50,000,000. . . . The picture above shows workmen placing a clamp preparatory to stringing another cable. At the left is a general construction picture.

Business and the Market

By Alfred M. Caddell

Financial Editor

THERE is scarcely a mail that does not bring to me the anxious inquiry: When is the securities market going to take a turn for the better? Or: Is now a good time to buy stocks, bonds or other securities? Or: I bought So-and-so at such-and-such a price and it is now much lower—should I hold on longer in anticipation of a comeback, or should I sell and take a loss?

Pertinent questions, these—and anxious ones Hence these few lines about this broad subject.

Briefly and frankly, there isn't a man in the wide, wide world who can give sure-fire answers to these questions. The so-called market experts or economists or bankers or other prognosticators are at variance with one another. Last year they were at variance with one another too, and ninety per cent of them were wrong. Indeed, the most salient fact from the debris of the panic is that things move in cycles, not unlike the cycles of the weather. Prior to the break we had a long bull upswing which led to talk of a new era, talk which took no cognizance of economic laws. But we do not have the same general run of weather over limitless periods of time and we cannot expect to have anything else of a similar nature indefinitely. Consequently the resulting collapse, or change of weather—long overdue—was bound to be more furious when it did arrive.

With everything moving in cycles, when the buying power of the people curtailed through maladjustments in the business world such as over-buying on the installment plan began to diminish, there was only one possible consequence—the economic structure founded on credit or mortgaging of the public's future simply tottered. Security prices held as long as possible after the regular business indices began to show a falling off, and then the security prices went with a bang.

It has often been said that the stock market anticipates business conditions six months in the future. But that saying isn't necessarily true. The stock market was wrong in 1929, and it is just as apt to be wrong this year. Right now it is in the doldrums and the chances are that it will remain there, until corporation reports show that business is at least holding its own. If the corporation reports show a slight increase, all the better. Then and then only may it be said that business has turned the corner.

The most stable indices that financial observers employ to gauge the trend of events are car loadings, steel operations, bank clearings, automobile sales, the harvests, exports and imports and similar factors, all of which dovetail with employment, with buying power of industries and consumers and consequently with general prosperity. It takes time to get this economic wheel started from the bottom, and it takes strength, courage and national ambition to get the economic wheel revolving at anything like a satisfactory pace. Until this pace is attained, stocks and other securities bought at higher prices must remain more or less frozen assets; it is a long pull, but the slower it is to get started the more certain it is to climb steadily. The prosperity ahead—and it is most certain to come regardless of political disturbances such as that caused by the tariff—should be all the more stable due to the hard struggle it encountered getting started. That much is certain. We have had acute depressions before and have always come back stronger than previously. It's the way of the world and the way of human nature. Prosperity cannot stay at a low pitch and neither can it remain too high. Paradoxically, there is nothing more certain than change.

The only thing an investor can do is keep his eyes employed looking for business indices. If the showings are not lower in the fall that is a good sign that security prices as a whole have reached bottom. If one has ready cash on hand then should be the most logical time to buy bonds, stocks whose companies have weathered the storm successfully, etc. It is the lucky—not necessarily the most intelligent—person who can pick the bottom, but an upswing should be a sustained one if it is founded on real business stability. The safest way to regard security value is to look upon the stock and bond markets not as agencies pointing the trend but rather following the trend. Without earning power, real or potential, no security is worth the paper it is printed upon.

Questions and Answers

Conducted by Alfred M. Caddell

Information on securities will be furnished readers of "SCIENCE AND INVENTION" free of charge by mail and through these columns. A 2-cent stamped, self-addressed envelope should be included in your letter. Address your inquiries to the Financial Editor, SCIENCE AND INVENTION, 381 Fourth Ave., New York City.

Question—I hold Cities Service at 48. Do you think it will ever come back to this figure? H. L. P., Boston, Mass.

Answer—Yes, I do think it will come back. Cities Service has enormous assets totaling more than one billion dollars. Its earning capacity has been consistent and there is no sign of anything different on the horizon. True, there is a large short interest in this stock, but it must be borne in mind that there are more than 365,000 partners or stockholders in this company and it is not going to be easy to keep the price down. All that is required is a little turn of events and Cities Service should be on the upgrade again.

Question—Do you think the suit launched against the Radio Corporation of America will be successful? I am the holder of a few shares of RCA bought at considerably higher levels and am concerned about the outcome of this anti-monopoly suit. A. R. D., Lincoln, Neb.

Answer—No one can tell what the outcome of this suit will be. Anticipation is more or less equally divided. If the plaintiffs win the suit the chances are that RCA's assets will be affected. RCA can hardly retain the role of market favorite indefinitely and the chances are that it will be some time before its market price will reach former levels.

Question—Do you consider Straus bonds safe at the present time? L. L. P., Richmond, Va.

Answer—The Straus securities have been considered safe for fifty years and that is the main precedent to go by at the present time. The company has conservative management, is a consistent dividend-payer and no one has had to take a loss on their securities. Straus is one of the leaders in the mortgage bond field.

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Editorial

AS we go to press, two extremely interesting pages of aeronautical history have been turned. The Hunter Brothers and sister flying a comparatively old second-hand monoplane which is credited with 70,000 miles of flight prior to the 41,000 odd miles made during the remarkable endurance flight of 553 hours, and the remarkable termination of the flight of Charles E. Kingsford-Smith and his companions around the world in another second-hand monoplane, purchased from Sir Hubert Wilkins after it had been cracked up in the Arctic, have demonstrated beyond the question of a doubt that we are well on the way to mastery of the air.

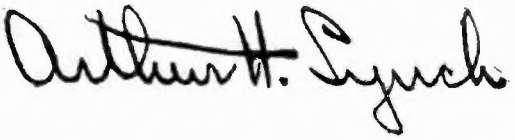
As a matter of fact, such rapid strides are being made in aircraft development that it is almost impossible for us to finish our work on any issue of SCIENCE AND INVENTION without having to comment editorially on some new aeronautical achievement.

Nor in dealing with the subject of aeronautics is it possible for us to pass unnoticed the remarkable gains being made in aircraft radio development. Within five hours after the Southern Cross had left the Irish coast, members of the staff of SCIENCE AND INVENTION were listening to the dots and dashes coming from her radio transmitter which indicated the progress of the flight. We were able to hold the Southern Cross until her arrival at Roosevelt Field. Communication of this nature would have been considered remarkable with hundreds of horse power a few years ago and the advance being made in aircraft radio is being indicated by the fact that the power used on the Southern Cross was approximately equivalent to that consumed by a single incandescent lamp of the type used in our homes.

WITH our rapid utilization of scientific labor-saving devices, we are creating a serious situation for ourselves by the very rapid increase in noise. Of course, efforts are being made in certain directions to reduce noise and a great deal of progress has been made, but there remains room for vast improvement. Our large cities are actually atrocious. This is especially true in the summer time, and up near the top of the list of offenders we find the over-powered home radio receiver shouting its questionable entertainment through open apartment windows.

Trolley cars and trucks with hard tires contribute a large share of the metropolitan din while honking horns and shrill police whistles make a hot day in the city business office almost unbearable. The removal of steel rails and steel wheels in favor of pneumatic tires and the installation of satisfactory but silent traffic signal systems, and the substitution of other methods for the steel riveting hammers used in the construction of steel buildings, would go a long way toward abating this rapidly growing nuisance.

TODAY'S skyscraper presents vertically slotted walls to the sun, to gain as much daylight as possible for the workers within. Tomorrow's skyscraper will widen the angles formed by the projections and slots (see "Towers Pierce the Clouds," July SCIENCE AND INVENTION), and leave a corrugated surface of glass framed in stainless metal, admitting a still greater proportion of the sun's rays. But day-after-tomorrow's skyscraper will be a sheath of steel within a sheath of steel, with heat-proof and sound-proof materials sandwiched between, and will have no windows at all. The sun is to be shut out entirely, because its light is neither uniform nor efficient. It casts shadows and dazzles the eyes. It brings too much heat in the summer and fails with every passing cloud. Instead, the engineers plan to install indirect lighting equipment, with portable fixtures, so that uniform, ideally regulated, shadowless light will be available anywhere in the building at any time.



"Those Who Refuse to Go Beyond Fact Rarely Get as Far as Fact" - - - - HUXLEY

5 days' driving trial

Drive the car you buy five days... *then decide!*

"Can I return it within five days?" "Yes, the Studebaker Pledge provides five days' driving trial for every buyer."

Pledge to the Public on Used Car Sales

1 Every used car is conspicuously marked with its lowest price in plain figures, and that price, just as the price of our new cars, is rigidly maintained.

2 All Studebaker automobiles which are sold as CERTIFIED CARS have been properly reconditioned, and carry a 30-day guarantee for replacement of defective parts and free service on adjustments.

3 Every purchaser of a used car may drive it for five days, and then, if not satisfied for any reason, turn it back and apply the money paid as a credit on the purchase of any other car in stock—new or used. (It is assumed that the car has not been damaged in the meantime.)

© 1930 The Studebaker Corporation of America

Five days on the road will tell you far more about the used car you buy than a five-minute demonstration. You test the car under the actual conditions it will meet in serving you. If it does not satisfy you, you may return the car and apply your payment on *any* car—new or used—in your Studebaker dealer's stock. This is one of the provisions of the famous Studebaker Pledge, recognized everywhere as the fairest, squarest used car sales policy.

More than 150,000 thrifty motorists bought Pledge-backed used cars last year. They bought because they wanted Studebaker Pledge protection—and because a good used car is always a better buy than a cheap car bought new.

Because most Pledge-backed cars have been thoroughly reconditioned before being offered for sale, you get good appearance, good performance, and good value with the car you choose. Certified cars sold under the Studebaker Pledge carry a 30-day guarantee. *Every* Pledge-backed car has its *lowest price marked* in plain figures—no codes.

See your Studebaker dealer *first* when you buy a used car—get the full protection of this famous Studebaker Pledge!

INVEST 2c . . . . YOU MAY SAVE $200

Spend 2c now for your copy of this interesting and instructive booklet, "How to Judge a Used Car"—it may save you as much as $200 on the used car you buy. Mail the coupon now!

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Can YOU Answer These Questions?

Who was Marie Antoinette?
How can a man be elected President though he receives a million votes less than his opponent?
Why is the sky blue?
Is this sentence correct? *He doesn't feel good.*
Who was Homer?
By what rule of economics does Charlie Chaplin earn more money than ex-President Coolidge?
Who said, "Give me liberty or give me death"?
Which freezes quickest—water, mercury, alcohol?
Do fish sleep?
What is a pentameter?
Who wrote *Virginibus Puerisque?*
What nation first divided time into months, weeks, hours, minutes and seconds?
Where was the Pantheon?
Why is glass transparent?

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SCIENCE *and* INVENTION

Volume XVIII. Number 5

SEPTEMBER 1930

Wings Around the World!

By Augustus Post

Aviation Editor

The Rôle of Prophet Is No New One for Augustus Post. In 1927 Glenn Frank Pointed Out That He Had Pre-Sketched the Lindbergh Flight in 1914. . . . The Present Article Surveys the Prospects for World Air Service in the Near Future

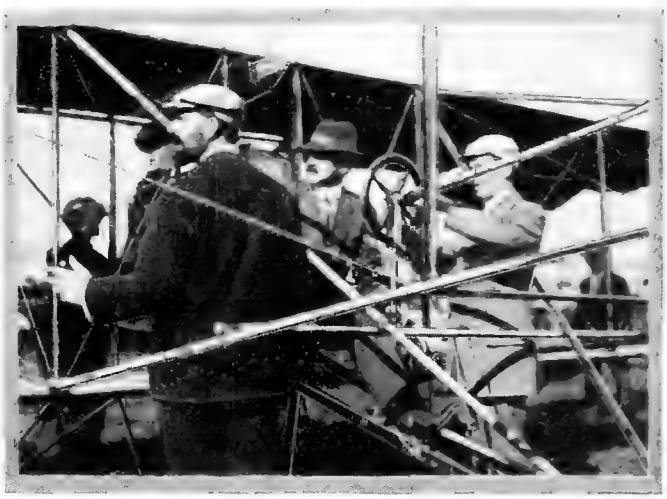
THE twentieth anniversary of the historic Curtiss flight from Albany to New York for the $10,000 prize put up by the New York *World* was celebrated by Mr. Curtiss' flying a Curtiss "Condor" twenty-passenger plane, one of the largest in regular service on any transport line in the world, over the same course which he flew on May 29, 1910. This year's flight gave a unique opportunity to compare the early machine with machines of the present day, and the first cross-country flight with the air routes of the world.

Mr. Elmer E. Robinson, chief mechanic for Glenn Curtiss, describes the plane which Mr. Curtiss flew:

"The plane was built under my supervision in a small shop in Hammondsport, N. Y., by eight employees. It was a pusher biplane with horizontal stabilizer and rudder in the rear and a biplane elevator in the front. The ailerons were placed between the wings and hinged on the outer rear wing strut and were controlled by a shoulder yoke worn by the pilot. The rudder was controlled by a cable passing through the lower rear bamboo poles. The motor was fifty horsepower, constructed in the Curtiss Motorcycle shop, and the airplane was covered on top of the ribs by rubberized silk.

"You can readily imagine the nervous tension when after weeks, and even months, of laborious preparations, Mr. Curtiss took his seat and I grabbed hold of the propeller to crank it. After warming the motor up he made a graceful take-off and started on what, at that time, seemed a tremendously long journey. We watched the take-off breathlessly and saw the plane disappear in the distance. This gave us all a peculiar feeling because all previous flights had been around the landing field with the plane always in sight and this was the first time we had seen an airplane fly away until it disappeared.

"The New York *Times* chartered a special train on the New York Central and Mrs. Curtiss and Augustus Post of the Aero Club of America, who with Alan R. Hawley held the balloon record of America, followed the plane down the River."



Mr. Post was one of the chosen who saw the Curtiss June Bug evolve, and one of the first to learn to fly the Curtiss pusher biplane. Here he appears with Glenn Curtiss, whelmed 'round by the bamboo and wires of a ship like that in which Mr. Curtiss flew from Albany to New York in 1910. *In the pilot's seat, Mr. Curtiss; left foreground, Mr. Post.*

I was pleased to receive an invitation from Mr. Curtiss to accompany him upon the twentieth-anniversary flight. I went out to the Curtiss flying field at Valley Stream with Mr. Alan R. Hawley, with whom I had done a great deal of ballooning in the old days, and we entered one of the "Condor" twenty-passenger transport planes. We flew direct to the Hudson River and followed the shoreline practically the entire way to Albany. At times our pilot allowed the plane to fly itself while he took motion pictures of the accompanying ships. The trip to Albany was accomplished in an hour and fifty minutes

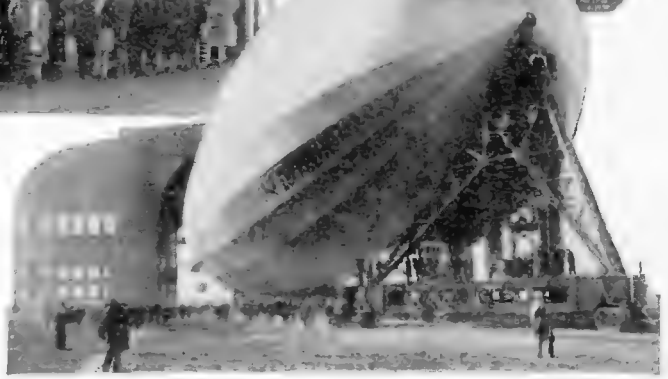
with the greatest of comfort and with stories to while away the time, related by the passengers, of the early days of flying and the hardships which seemed to make the present journey far more comfortable than the wildest dreams of the early enthusiasts.

After lunch, Mr. Curtiss took off in the "Condor" in which we had flown from New York City. When we reached an altitude of 3,000 feet passing over the city of Albany, Captain Courtney turned over the controls to Mr. Curtiss so that he could follow the exact course which he had flown twenty years before.

"The controls," declared Mr. Curtiss, "seemed even more sensitive than those of the small light machine in which I made the original flight. We found it difficult to pass the New York Central train on the first flight, which was made at the speed of 52 miles an hour, a few hundred feet above the surface of the water; and motion pictures were made from the door of the baggage car. The "Condor" today easily left the trains behind, cruising along at double their speed at an altitude of from 3,000 to 4,000 feet, and the motion pictures this time were taken from the side door of another plane. And we took almost all those who rode on the train which followed us down the river, on board the airplane today."

Four years ago only one airline in the United States, the Western Air Express, was carrying passengers on a daily schedule. Last year the Aeronautical Chamber of Commerce stated that 3,160,793 passengers were carried; 97,995 miles are flown daily over 46,360 miles of airlines, and a grand total of 197,546,590

(*Continued on page* 452)

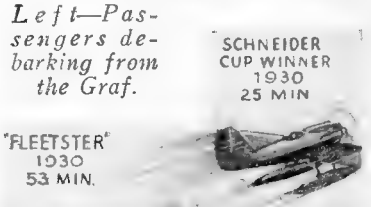


Top right — A 206-passenger Christmas cantilever mon plane, compared with the Spirit of St. Louis. Above— A tandem-engined 32-passenger Fokker.

Above—The Graf Zeppelin being maneuvered into its hangar at Lakehurst by the new tractor stub mast.

Left—Passengers debarking from the Graf.

Left—The Junkers G38.


SCHNEIDER CUP WINNER 1930 25 MIN
"FLEETSTER" 1930 53 MIN.
CURTISS "CONDOR" 1930 20 PASSENGER 1 HR. 30 MIN
GLENN CURTISS 1 PASSENGER 2 HRS. 35 MIN. 1910
"CHAMPLAIN" 1835 9 HRS. 31 MIN.
FOBT FULTON "CLERMONT" 1807 32 HOURS
HENDRICK HUDSON "HALF MOON" 1614 5 DAYS
EMPIRE STATE 2 HRS. 40 MIN.
NEW YORK — 150 MILES — ALBANY

Manhattan's skyline.

Ewing Galloway

The Capitol, Albany.

Ewing Galloway

How *to* Match *the* Hull, Motor *and* Propeller *of your* Outboard

Olga Sorkin, newest member of the A.O.A., inspects a two weeks' collection of trophies won by J. Phillips Dykes, author of this article. Miss Sorkin will drive a Fairchild hull with a Johnson B-Class 16 h.p. motor.

By J. Phillips Dykes

The Second of a Series . . . The First—"What to Do When Your Outboard Balks"—Was Printed in August

HAVE you ever wondered why your old-fashioned flat-bottomed rowboat will make only six miles an hour regardless of the amount of power you hang on the transom? There really is nothing mysterious about it at all, yet very few outboard lovers really know why it is so necessary to have hull, motor and propeller in the proper relation to each other in order to get maximum efficiency.

Look at the first three sketches. Number 1 represents your flat-bottomed boat. Notice how the water piles up in front of the bow in a solid wall? That wall represents hundreds of pounds of pressure applied directly against the thrust of the motor. The harder the motor works, the larger the wall of water becomes, and the stronger the back pressure. Which explains why the motor becomes overheated and either burns out the bearings or freezes the pistons after a very few minutes.

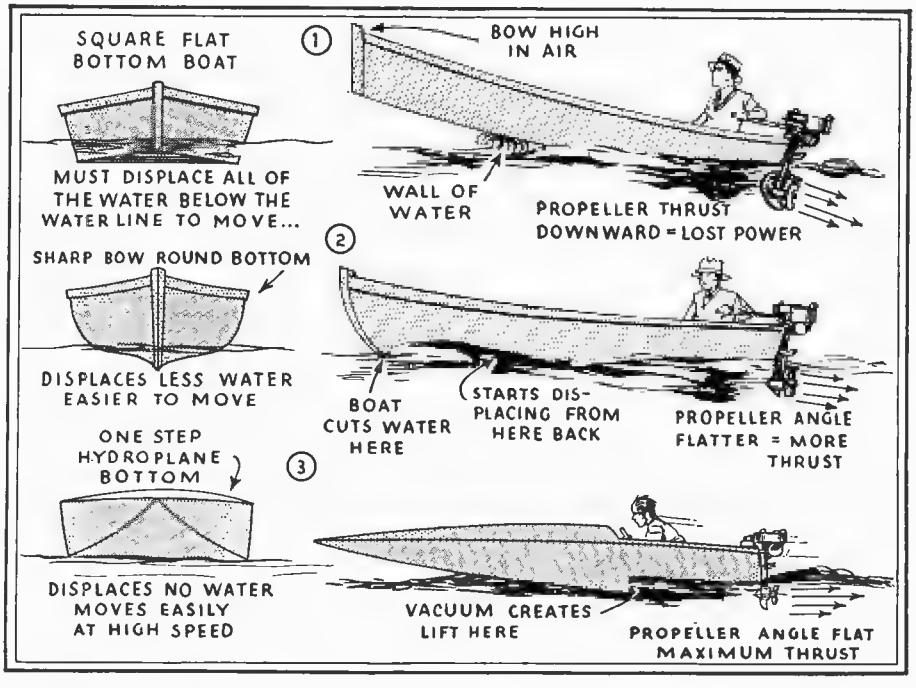
Sketch number 2 represents the sharp-prowed, round-bottomed boat of which there are thousands in daily use. This boat rows easily because the extreme bow cuts the water and rolls it slightly to the sides, allowing it to recede while the oarsman is recovering his stroke.

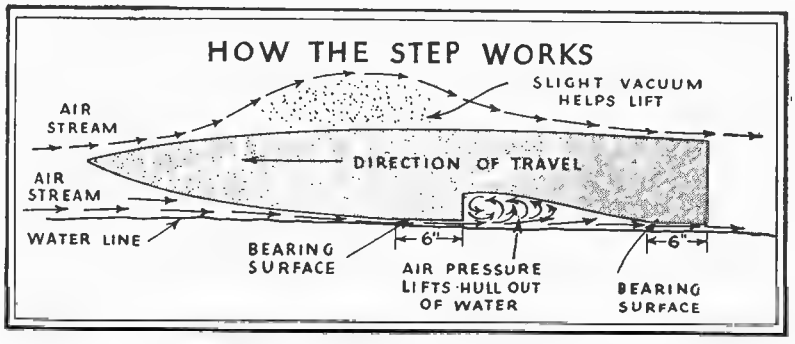
When a powerful outboard motor is applied to this boat, up to a certain point the water acts as for the oarsman, then when speed is attained, the boat rises out of the water forward, and the principle of the flat bottom applies, because the bow is lifted clear of the water and all the pressure is encountered by the after portion, which is flat.

You can readily see that this type boat will develop speeds up to ten or fifteen miles per hour, but from this point on it becomes necessary to apply such excess of power that it becomes impracticable to attain higher speeds without sacrificing safety.

Sketch Number 3 shows the conventional single-step hydroplane, the foundation for all real speed in the water. This boat will not get out of the three-mile-an-hour class unless high speed motors are applied to it, as it is also more or less flat bottomed. However, when a high-powered motor is applied, the step causes air to be sucked from both sides and from the bow, along the bottom of the boat, creating a powerful vacuum just aft of the break in the bottom line.

This vacuum causes the boat to lift entirely (*Continued on page* 454)


SQUARE FLAT BOTTOM BOAT
1
BOW HIGH IN AIR
MUST DISPLACE ALL OF THE WATER BELOW THE WATER LINE TO MOVE...
WALL OF WATER
PROPELLER THRUST DOWNWARD = LOST POWER
SHARP BOW ROUND BOTTOM
2
DISPLACES LESS WATER EASIER TO MOVE
BOAT CUTS WATER HERE
STARTS DISPLACING FROM HERE BACK
PROPELLER ANGLE FLATTER = MORE THRUST
ONE STEP HYDROPLANE BOTTOM
3
DISPLACES NO WATER MOVES EASILY AT HIGH SPEED
VACUUM CREATES LIFT HERE
PROPELLER ANGLE FLAT MAXIMUM THRUST



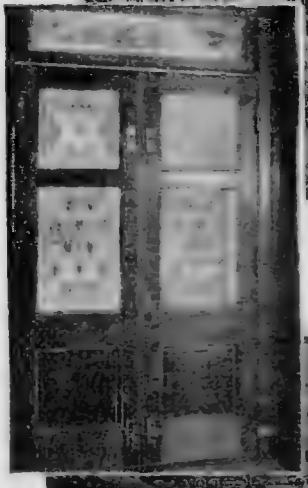
These drawings illustrate the effect of three different types of outboard hulls on the water through which they are driven. The advantage of the hydroplane craft is graphically shown.

Doors That Lead Nowhere . . . Two-and-One-Half-Inch Steps . . . Trap Doors on the Floor Level . . . Balconies with No Entrances, in a House Built for Spirits

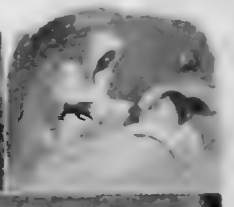
Some of the windows of the Winchester Mystery House are of plate glass, ground like lenses, so that when looking through them the scenery is magnified. Mrs. Winchester scorned automobiles. She is seen seated in her favorite carriage.

The House that Ghosts Built

By Uthai Vincent Wilcox



Above—A storeroom with rare windows, gold and silver fixtures. Left—Thousand-dollar doors that have never been opened.



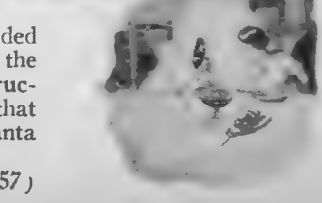
NEARLY fifty years ago, in New Haven, Connecticut, a devoted young wife lost, within a few weeks of each other, a baby and a beloved husband. These events had a shattering influence on her personality and caused her to seek a happier spot in California.

An ardent believer in spirit forms, she sought in the West to obtain some consolation in activity.

She was Mrs. Sarah L. Winchester, widow of the son of the founder of the famous firearms concern. With unlimited money at her disposal she was able to fulfill every whim and

The "Goofy" stairs have steps 2½ inches high, and 46 are required to ascend less than ten feet. There are nine turns back and forth. The steps have a piano finish.

A dining room 20 by 40 feet, in birdseye maple. Here Mrs. Winchester dined with twelve spirit friends, on gold dinner plates. Right—A blind window with a mystic message.

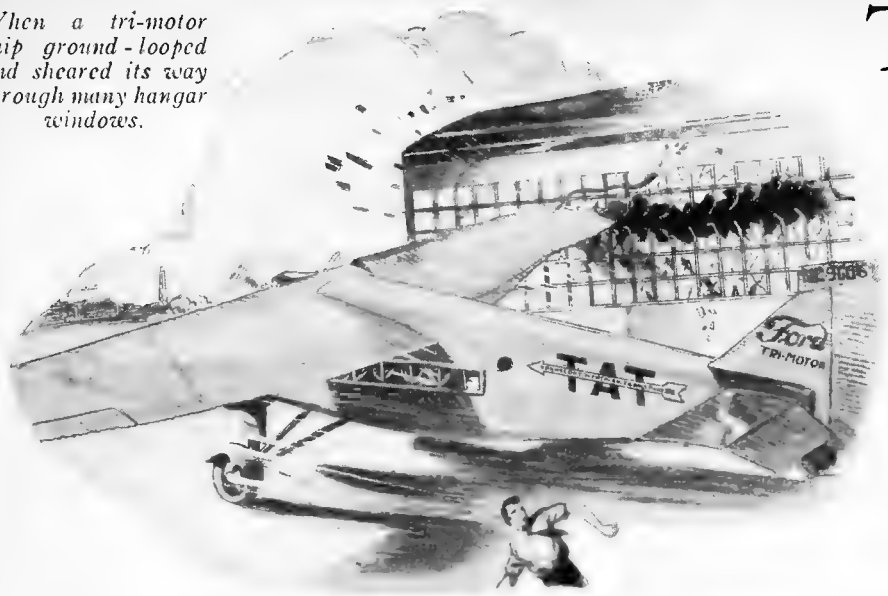


expression that seemed to come to her from her spirit friends.

Her unseen friends told her that she could vanquish death by forever building. Through a medium she was persuaded to continue her mad frenzy and so cheat the Dark Angel by never stopping in the construction of her new home, which she was at that time erecting on Stevens Creek in the Santa Clara Valley of California.

Having both the (*Continued on page 457*)

When a tri-motor ship ground-looped and sheared its way through many hangar windows.



The Missing Member *of the* Crash Board

By William Watts Chaplin

Former Staff Reporter with the Associated Press

THE first passenger run of the train-plane system of the Transcontinental Air Transport marked the opening of a new era in cross-country travel, but for me it also answered a question and fulfilled a wish.

The question, which had long been in my mind, was as to just how much a pilot really knows about the crash of a plane he is operating—what his value as an expert is in the determination of cause of the crash. And the wish, arising entirely from curiosity, was that I might be in an airplane accident so that I might learn exactly what the sensations were.

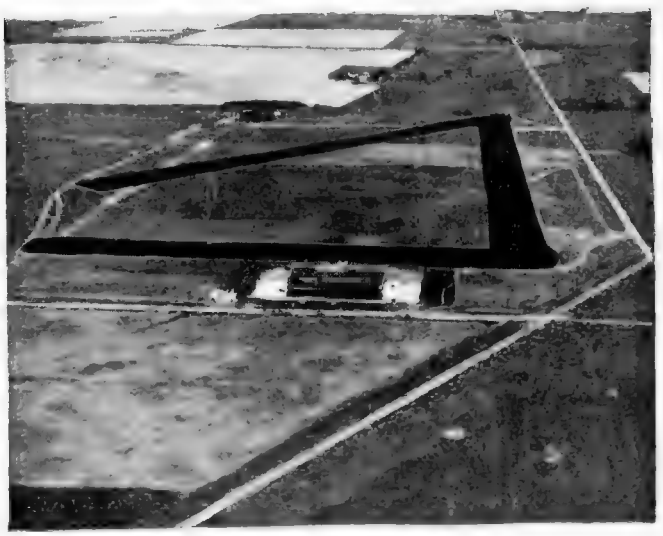
Of course what I wanted was a nice neat accident with absolutely no broken bones and as few bruises as possible; and, fortunately for me, that was exactly the kind I got.

The first group of passengers to travel the T. A. T. line westward left the Pennsylvania Station in New York City on the evening of last July 7, our journey by train to Columbus, Ohio, and by plane the next day to Waynoka, Okla., being uneventful, although we left Columbus in a blustering rain. The Santa Fe Railroad took us the second night to Clovis, N. M., and it was there we had our trouble.

There were two plane-loads of passengers, and one group, including Amelia Earhart, who like Col. Charles A. Lindbergh is a T. A. T. official, took off from the fine new airport without incident. Then the plane I was scheduled to ride in, the City of Los Angeles, taxied up the runway and wheeled to take off into the wind. The pilot, J. B. Stowe, one of the best in the service, opened the throttle and we started.

But the City of Los Angeles was not to fly that day. Down the runway we came with gathering speed, intending to flash past the hangar, one side of which was about half glass, and then lift into the air. Thirty miles an hour, forty, fifty, sixty. The tail lifted and the great wheels skimmed the ground as lightly as though the plane were a humming bird instead of an all-metal monster of the air.

The Waynoka, Okla., airport is similar in type to the field at Clovis, N. M., where the big plane in which Mr. Chaplin was a passenger made its unexplained attack on the hangar. Below — two views of an all-metal passenger plane.



THE all-metal plane and the T. A. T. system proved their worth on the occasion of the accident described by Mr. Chaplin in this story. Thanks to the plane, no one was injured. And thanks to the system, another plane was immediately available. . . . This is the fifth dramatic close-up by Mr. Chaplin to appear in SCIENCE AND INVENTION. The fourth, "The Sky Navy's Playful Porpoise," was printed in the August issue.

And then something happened. There was a crunching jar; the plane ground-looped with amazing speed; and we were headed a mile a minute for the many-windowed wall of the hangar. I don't know how much breathing was done in the second before we struck that hangar, but I do know that the sum total was not increased one iota by me.

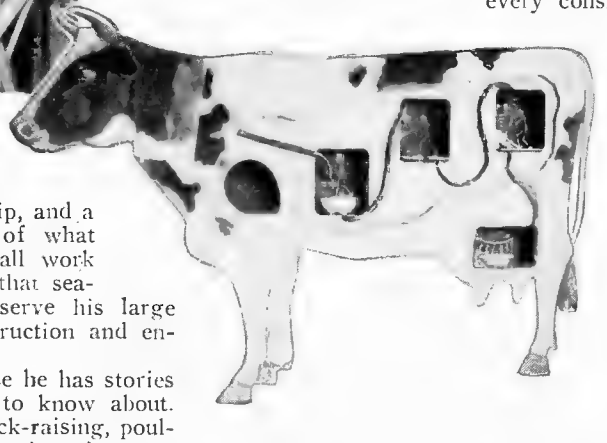
Stowe was an old hand and he kept his head. If he hadn't kept his in the figurative sense we would very likely have all lost ours literally. He worked frantically at the controls, and to such good effect that we did not strike the hangar squarely, but only with one wing. The wing cut through the long windows like an axe mowing down a row of icicles.

There was a crash of splintered glass and rending metal and we came to a sudden halt that threw us forward from our chairs. We looked at each other with wide eyes, unable to believe that we had gone through that mad moment without death or even injury. There were nine of us in the plane, including two women, one of whom had never been in the air before this journey, but there had been (*Continued on page* 453)

Uncle

Cows Demonstrate and Pigs Preach to the Fair Crowds When the Wily Old Showman Pushes the Button on the Ingenious and Instructive Exhibits His Smart Nephews Contrive

Left — The stage manager who engineers the operation of the bossy at the top of the page. Below—another version of the demonstrating cow, who shows the multitude how she manufactures milk.



SCIENCE, art, craftsmanship, and a grand old Yankee sense of what constitutes a good show all work strong for Uncle Sam, when that seasoned promoter sets out to serve his large conglomerate family with instruction and entertainment.

He does it, primarily, because he has stories to tell that the family ought to know about. Stories about dairying and stock-raising, poultry farming and forest conservation—improvements he has developed, economies he has discovered, new ways and right ways of doing things. And because his demonstrations are the product no less of showmanship and a sense of the spectacular than of practical science, the family stops and looks and listens to the tune of 6,000,000 to 10,000,000 a year.

He plays the fairs, mostly—not overlooking a chance to get his stories across, of course, at special expositions where big crowds of folks collect. And wherever people are once acquainted with his stuff he is sure to be invited to participate—abroad as well as on his own shores. One big reason is that each time he comes he rolls from his box a brand-new, extremely original and ingenious mechanical trick.

Down in the latitude of the placid Potomac Uncle Samuel has his incubator of sensational scientific exhibits going full tilt the year 'round. There the busy brains of some of his smartest nephews—engineers, sculptors, photographers, painters, exhibit experts, inventors, and craftsmen in wood and metal—operate ceaselessly to contrive new means and methods of arresting and holding the attention of his farflung family, in competition with the thousand other engines of entertainment met with at every considerable exposition or fair.

So successfully does his incubator compete that advertising enterprises all over the world watch Uncle Samuel's shows like so many hawks. His sparkling new ideas, you see, are not patented or copyrighted. He uses them once and then discards them, whereupon they pass as free booty to the advertising profession.

Did you ever think of making swine and cattle of thin rubber, so that they might be inflated gradually from concealed sources to simulate the process of growing and fattening on various feeds?

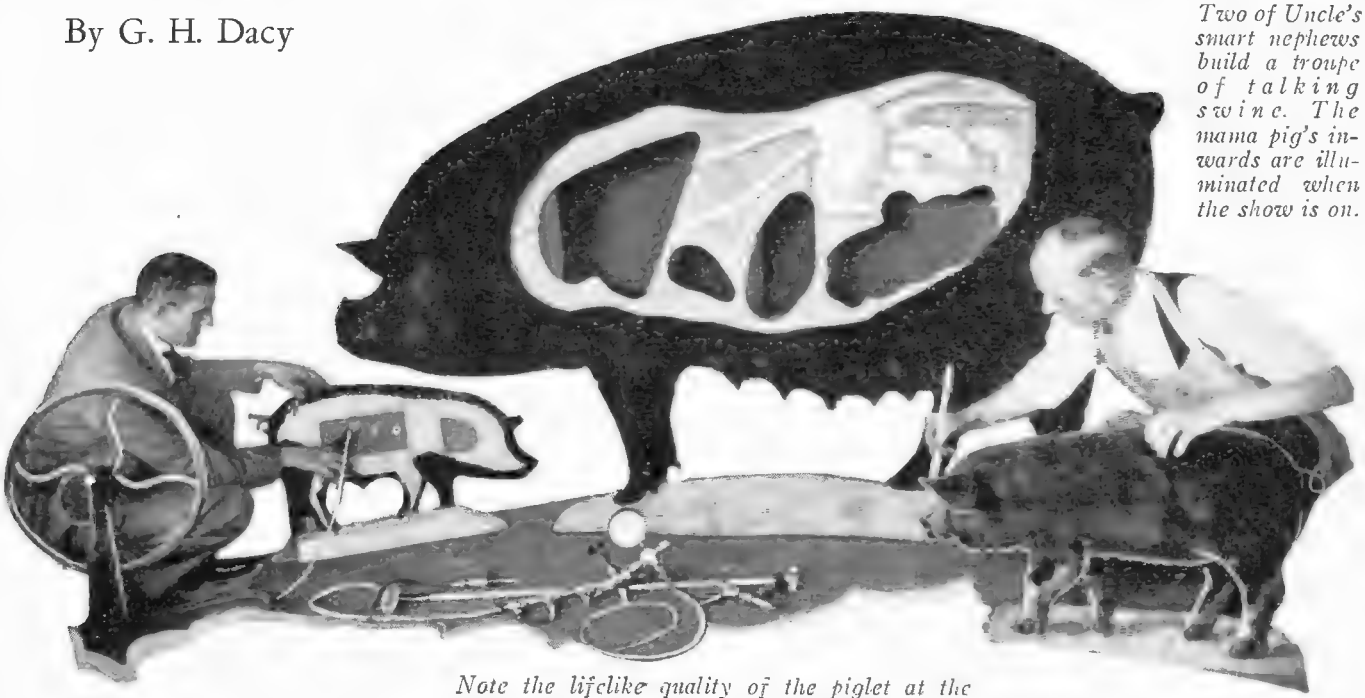
That's one of the ideas sprouted in your Uncle's show hatchery for the season of 1930. And ten to one his smart nephews will make it work. It happens to be no easy feat, by the way, to put this one across.

First off, the model pigs in this show were made of dental rubber, and compressed air under special valve control made them grow. But dental rubber isn't rugged enough to stand the strain of trouping, and furthermore it lacks the rigidity necessary to the most stunningly natural effect. So, having proved the idea feasible, the show hatchery boys began to cast about for a better skin.

Rubber salvaged from heavy-duty inner tubes was found satisfactory for the pneumatic piglets, but then came the problem of vulcanizing a rubber form of this size. No vulcanizers of the large capacity demanded were available in Washington, and tire manufacturers pronounced the job out of their line. However, the show incubator has never

Sam's Mechanical Live Stock

By G. H. Dacy

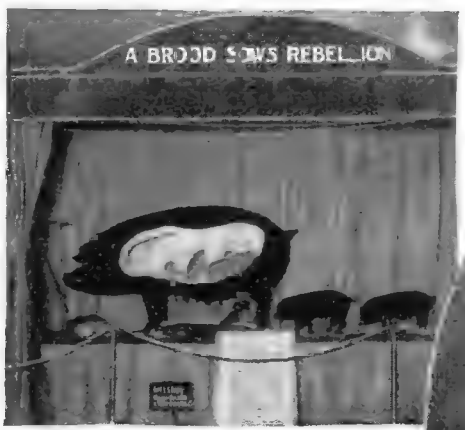


Two of Uncle's smart nephews build a troupe of talking swine. The mama pig's inwards are illuminated when the show is on.

Note the lifelike quality of the piglet at the right. The one at the left is having his valves tested with air.

yet fallen down on realizing an idea. When apparently up against it, the organization has always done better than its best. So it would be no surprise to us to learn that by now the problem has been solved, and that the vulcanized swine act was ready to delight eager spectators at the big fairs.

Among other current productions at the national play factory is a sheep family whose vocabulary has been increased from a mere sarcastic "Baaa" to a dialogue that would astonish its flesh-and-blood relatives. Each sheep is a three-dimensional form, wearing an honest-to-goodness natural (*Continued on page* 459)



Left—Here's the talking pig show set up for action. As a grand finale the piglets explode and fall flat.

Artists and mechanics work ceaselessly to build lifelike actors for Uncle Sam.

One marvelous piece of ingenuity is a mechanical man milking a mechanical cow. Here the performers are in process of construction.

Have You *an* Echo In Your Pocket?

By S. R. Winters

Encased like a Chinese miscreant or a spiritualist medium under test, Mr. Chrisler of the Bureau of Standards directs the search for echoes. The cabinet prevents his clothes from affecting the sound.

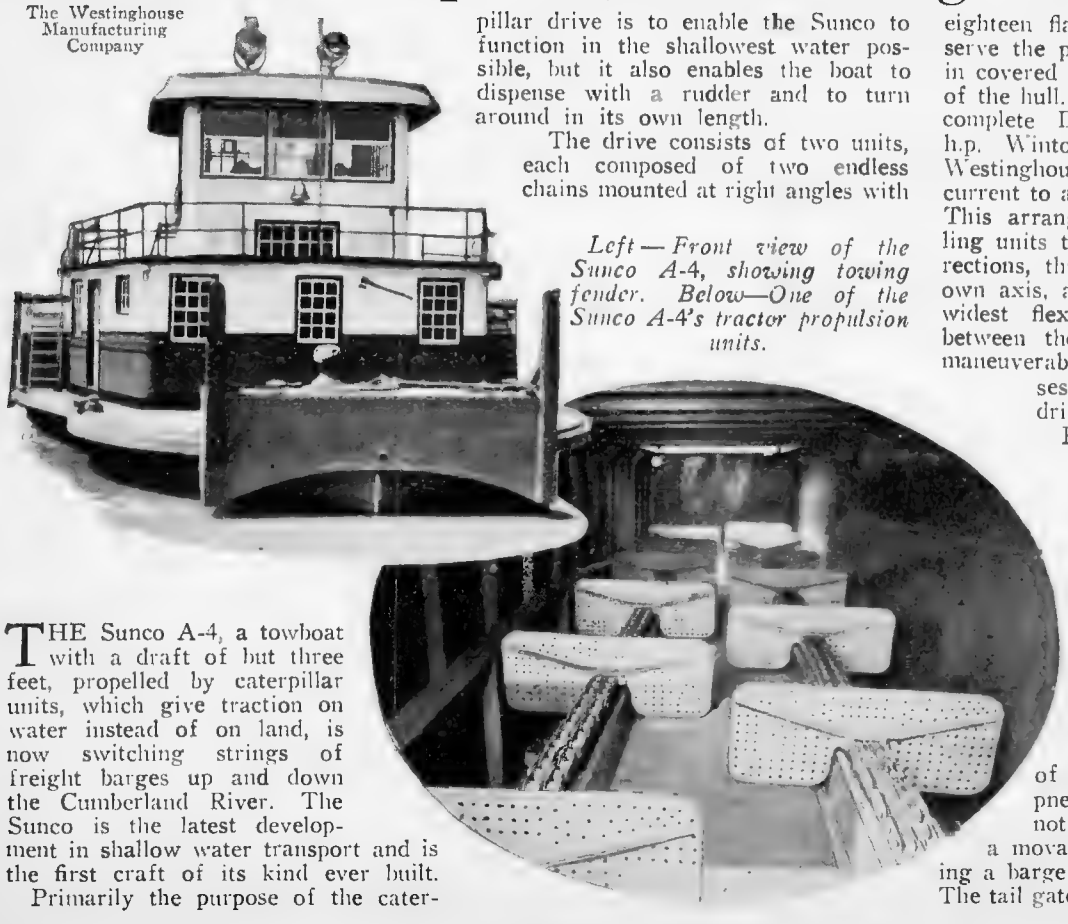
A "little theater" all its own is being sponsored by the Bureau of Standards. Unique in that it is operated neither for entertainment nor profit, this experimental theater is designed exclusively to study the acoustic properties of structures devoted to the exhibition of talking motion pictures. In reality, a reverberation or echo chamber serves as quarters for this make-believe talking picture theater of Uncle Sam, and the audience is made up of workers on the staff of the Bureau of Standards.

With sound becoming an ally of sight in our entertainment houses and with the two riding on a crest of unexpected popularity, many of the motion-picture operators found their buildings improperly constructed for the reception of sound. The "echo" effect was pronounced. To compensate for the so-called "reverberation time" or echo effect, the sound-absorptive properties of the walls and ceilings of theater structures are being increased.

Obviously, however, many of the existing motion-picture theaters cannot be altered readily and inexpensively to meet the sound-absorbing qualities demanded by the talking picture. Hence, the Sound Section of the Bureau of Standards is studying the use of upholstered seats in theaters as a means of making corrections for the "reverberation time" or echo effect in sound "talkies." Even the sound-absorbing effect of clothing worn by the theater-goers is being investigated.

The Good Ship "Crawls-Through-The-Water"

The Westinghouse Manufacturing Company



Left—Front view of the Sunco A-4, showing towing fender. Below—One of the Sunco A-4's tractor propulsion units.

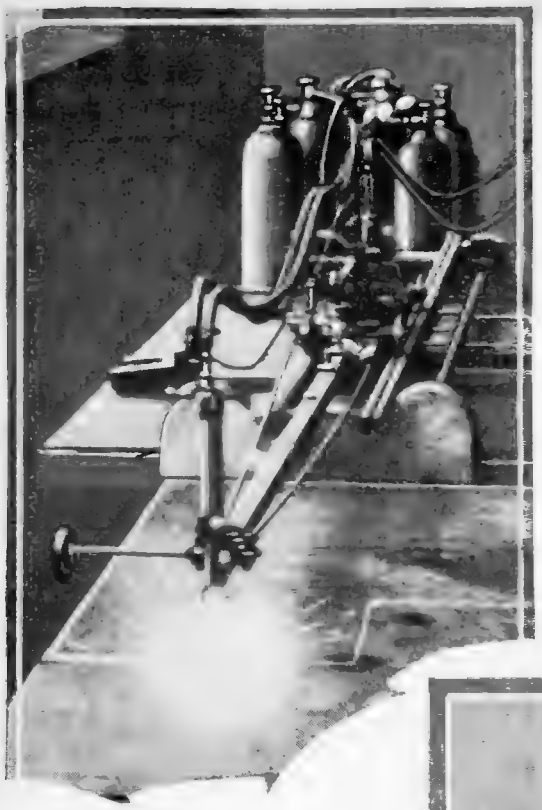
THE Sunco A-4, a towboat with a draft of but three feet, propelled by caterpillar units, which give traction on water instead of on land, is now switching strings of freight barges up and down the Cumberland River. The Sunco is the latest development in shallow water transport and is the first craft of its kind ever built.

Primarily the purpose of the caterpillar drive is to enable the Sunco to function in the shallowest water possible, but it also enables the boat to dispense with a rudder and to turn around in its own length.

The drive consists of two units, each composed of two endless chains mounted at right angles with eighteen flat rectangular blades which serve the purpose of paddles, installed in covered passages, one on either side of the hull. Each unit is operated by a complete Diesel-electric plant—a 100 h.p. Winton Diesel coupled to two Westinghouse generators, which supply current to an eighty h.p. electric motor. This arrangement permits the propelling units to be driven in opposite directions, thus turning the craft on its own axis, and also makes possible the widest flexibility in speed variation between the two units, and hence a maneuverability and control not possessed by any boat otherwise driven.

Paddles and chains are made snag-proof by streamline gratings extending below the water line.

Control on the Sunco A-4 is concentrated in the pilot house. From this point one man can regulate propulsion and steering, operate the searchlights mounted on the roof, and shift the position of towing fender or tail gate. The control of the features last named is pneumatic. The towing fender is not accurately named, since it is a movable member used for pushing a barge train at any angle desired. The tail gate is the real towing member.



Shears *of* Flame

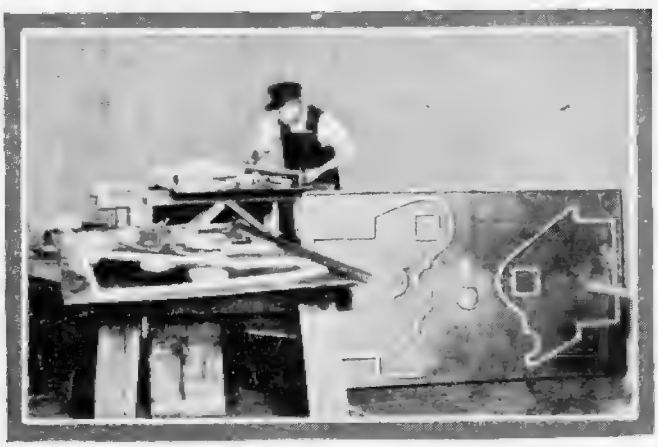
By Olaf Toulson

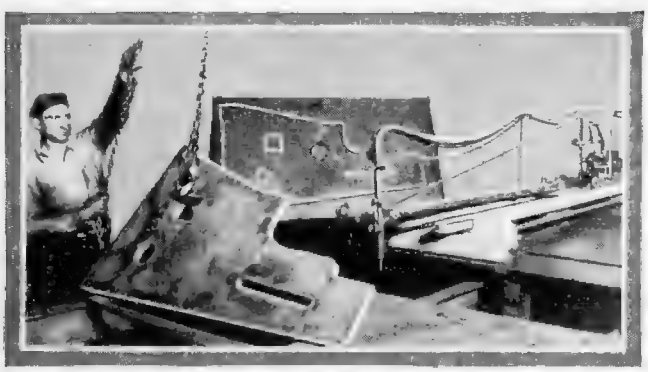
You Give Your Order for a 50-Ton Crane Hook or a Forming Press of the Jumbo Type . . . and the Oxy-Acetylene Shop Lays It Out and Automatically Tailors It to Pattern for You, Complete, from Great Sheets of Steel Plate, with a Cutting Tool of Blazing Gas

THE sharp edge of a jet of acetylene, burning fiercely at the muzzle of a blowpipe, and guided in a set path by a templet, is superseding the foundry and the forge as a means of forming heavy metal parts in a segment of considerable width in the industrial field.

There is little doubt that the new process is destined to bring about a revolutionary change in the metal industries. It is ideally fitted to achieve this effect. It is not only more economical but more efficient. It is not only more rapid but more accurate. It is not only more flexible than the methods it is replacing but also immeasurably simpler with respect both to the equipment used and to its application to the job. It reduces the amount of floor space necessary to the manufacture of complex machines, simplifies inventories, and cuts down the number of types of skilled workmen needed to a remarkable degree.

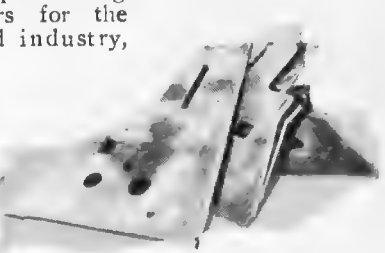
The combined simplicity, flexibility, and accuracy of the oxyacetylene process are most remarkable. Out of steel plate, rolled in the mill, and varied according to purpose in composition and thickness, parts for complete machines are cut automatically by the flame from a blowpipe. Housings, rams, beds, and even gears are produced by this method. And so accurate is the work that in many instances the part can be cut in finished size directly from the metal. In any case the edge left by the cutting flame is so clean that only a minimum of machining is needed to finish the piece. The wide range of heavy parts that can be formed by the blowpipe method is evidenced by the fact that material up to fifteen inches in thickness is being handled on a production basis at the present time.

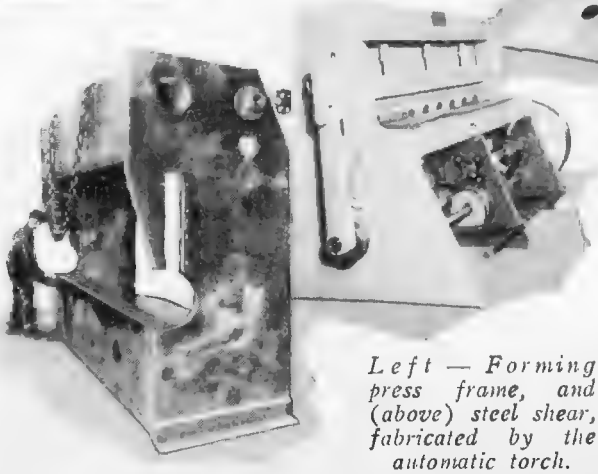




Upper left—The "shear of flame" at work. Above—Building the aluminum strip templets which direct the course of the automatic torch. Left—Workman lifting completed shape from automatic cutting machine. Templet appears in background.

Squaring shears for the steel industry,





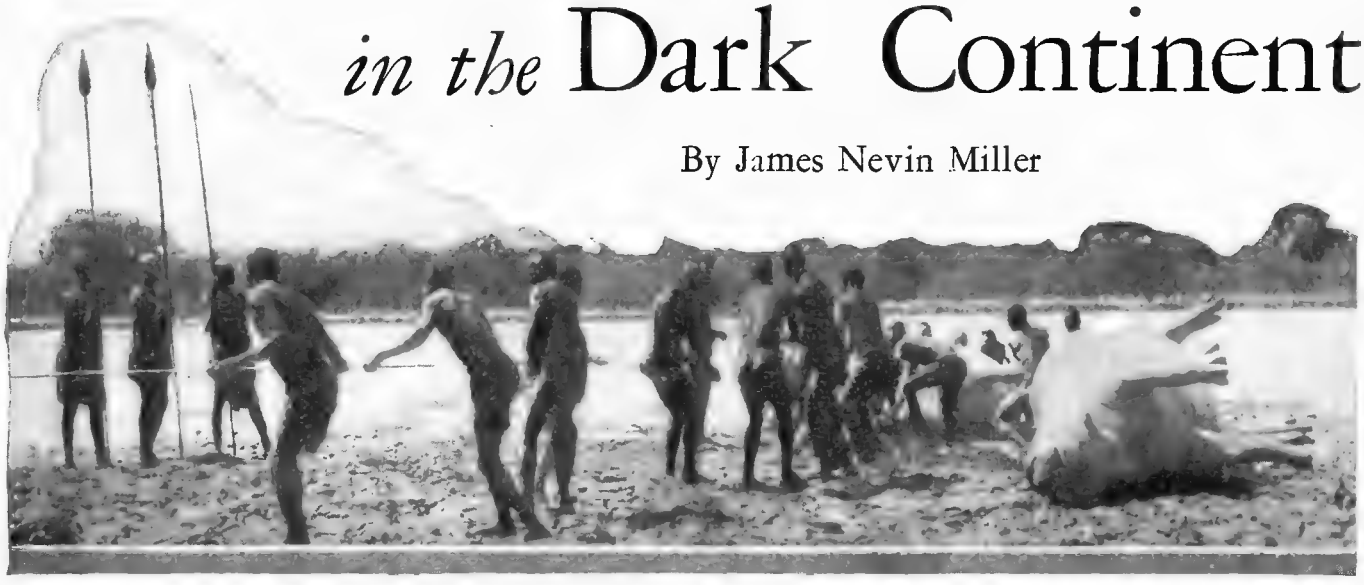
Left — Forming press frame, and (above) steel shear, fabricated by the automatic torch.

forming presses, cams, baffle plates, dipper lips and teeth, clutch discs, reverse links, manhole and feed door openings, connecting rods, crossheads, crankshafts, forming and trimming dies, and innumerable shapes of odd contour are some of the forms now being produced from steel plate by the oxy-acetylene automatic process. In some

(*Cont'd on page* 458)

There's Mystery Still *in the* Dark Continent

By James Nevin Miller



The Hen-Pecked Tuaregs and the Clacker-Lipped Mazza Girls Are Fairly Well Known . . . But Hunters Who Understudy Birds, a Chief with Twenty (20) Old-Fashioned Housewives, and the Gougoudou Wireless with Which You Can Order Lunch at a Point Miles Ahead Are Things That Deserve a Wider Audience. . . . The Haardt Expedition Met and Enjoyed Them All

Above — Natives drag a rich haul of hippopotami ashore. Left — Bangui natives ready for a religious dance, their bodies painted with bark, clay and ashes.

At the right, natives are carrying in a prize—a lion shot by the expedition in the Belgian Congo. The photograph at the lower right is of a rhinoceros brought down by Explorer Haardt.

AFRICA is still a land of strangely alien life, as far as Western civilization is concerned, according to Colonel Georges-Marie Haardt, whose caravan of eight motor trucks successfully negotiated 15,000 miles of often inhospitable terrain in the Dark Continent.

Colonel Haardt's caravan crossed the very heart of Africa, and the territory traversed varied from barren, uninhabited desert to jungle land where a veritable army of natives had to clear the way for the trucks. Much of the route had never before been traveled by modern vehicles.

Again and again the explorers had to fight their way through raging jungle streams, building their own bridges or making ferries of the surrounding brush, which frequently was so flimsy that it barely supported an automobile.

On one occasion a group of untamed desert outlaws had to be bribed to guide the automobile caravan across vast stretches of the uncharted Sahara. Through the courtesy of the Belgian authorities, more than 40,000 natives were utilized in blazing a trail, perhaps never to be utilized again, through 375 miles of otherwise impenetrable jungles of the Belgian Congo.

One purpose of the expedition was to trace a route by which France might project a railroad to link its vast provincial holdings in Africa. The automobiles were all French Citroën cars, equipped with caterpillar systems in addition to regular front wheels. Each car had a trailer, and both cars and trailers had to carry extra water, gasoline and oil talks.

Besides Colonel Haardt, the personnel consisted of his two assistants, M. Louis

Two examples of the African beautician's art, both treated with wooden plugs in various forms.

Diagonally to left a Congo jazz-band is getting ready to broadcast. Note the gourd xylophone. The lady below has taken a beauty clay treatment, and, conforming to the custom of the country, is wearing it in public.

Dubreuil, and Major A. Bettembourg; a movie man, M. Leon Poirier; M. Georges Specht as camera operator; an artist, M. Alexandre Jacvleff; Dr. Eugene Begonier, physician and taxidermist; M. Charles Brull, mineralogist and geologist; and nine mechanics, all familiar with Sahara travel conditions.

The first stage of the journey was a five-day drive across the great desert to Burem on the Niger River. One area of this region was the virtually unknown Tanezroutft, a country devoid of resources for 330 miles: no water, no wood, no grass, no living thing whatsoever. Here the explorers came upon bleached dried skeletons of travellers who had died of thirst. The strength of the sun's rays was indescribable, Colonel Haardt says, and if this hardship were not enough, there were the further ones of the evil smell of gasoline amid the terrific heat, besides a tremendous rear wind which whipped the skin raw.

Fortunately the Tuaregs who inhabit the region were easy to bribe (*Continued on page* 456)

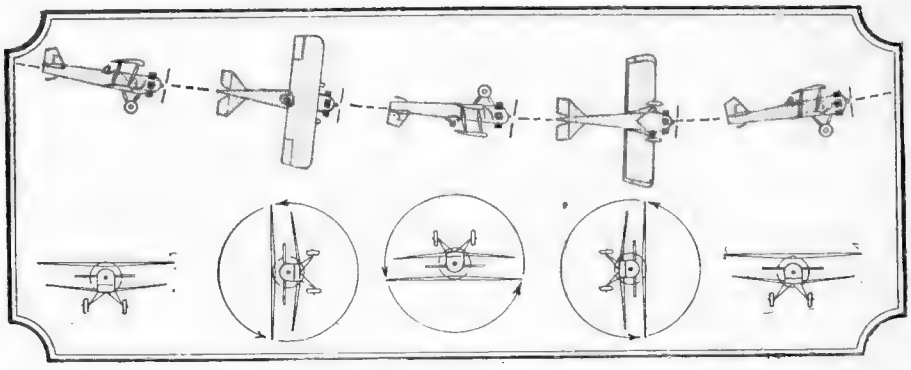
Above—An exhibit of native art on the wall of a hut; and a panoramic view of the Haardt motor caravan strung out across the desert. At the left, the caravan is about to cross a stream on a makeshift bridge of brush. In all, 127 water courses were traversed, most of them in this fashion.

Over *and* Over Again

By Betty Elkins Lund

Reader of* Science and Invention *Tells How She Accomplished 67 Barrel Rolls in 28 Minutes, Breaking Women's Record

Betty Elkins Lund, a reader of this magazine, who broke the barrel-roll record for women, after only twenty minutes of solo flight.



An accurate diagram of the capers a plane cuts in making a barrel roll.

PRIOR to this record-breaking flight in Miami (my fourth solo) I had only 20 minutes to my credit in the air, alone, and I had never performed any stunts. But my husband, Freddie Lund, was the first pilot to perform an outside loop in a commercial airplane, and he had taught me to fly, and taken me around. So I felt quite confident.

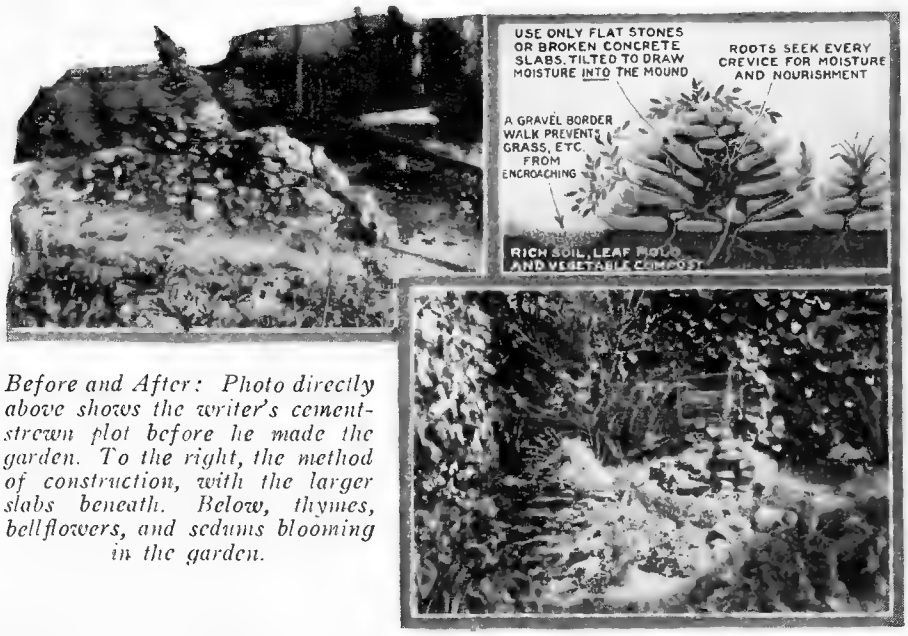
We had agreed to his signaling me from the ground, so that I could know how many rolls I had made. For each of my first twenty he was to lay a long, white strip of muslin on the ground; he was to cross one of these strips with another for every ten succeeding rolls.

I buckled into my parachute, kissed my husband good-bye, listened to his last-minute instructions, climbed into the cockpit and taxied down the field, waving to my husband; Mr. Lou Severe, the official representative of the National Aeronautic Association; Young Stribling, the boxer (who is also a pilot); and the crowd of spectators. For a while I held the plane low as I took off straight into the wind, and waved once more to those below me. Then I quickly climbed for altitude.

All the while I kept thinking of the things I had been told to do, and those I had been warned against doing. I wondered if I would be frightened when I (*Continued on page* 463)

A Rock Garden—Where Beauty Flowered Over Ugly Slabs

By Harry Seelye


USE ONLY FLAT STONES OR BROKEN CONCRETE SLABS, TILTED TO DRAW MOISTURE INTO THE MOUND
ROOTS SEEK EVERY CREVICE FOR MOISTURE AND NOURISHMENT
A GRAVEL BORDER WALK PREVENTS GRASS, ETC. FROM ENCROACHING
RICH SOIL, LEAF MOLD AND VEGETABLE COMPOST

Before and After: Photo directly above shows the writer's cement-strewn plot before he made the garden. To the right, the method of construction, with the larger slabs beneath. Below, thymes, bellflowers, and sedums blooming in the garden.

AN unsightly pile of broken concrete slabs or flat stones can be transformed into a charming rock garden. The writer was confronted with the problem of disposing of the remains of a short cement walk, and concluded it would be easier to plant something over the pile than to cart it away to a rubbish heap. With an absurdly small amount of labor the pieces were built up into a small rock garden that is the most attractive part of our rear lawn.

You can easily build a similar garden. The important thing is to have irregular slabs of concrete or flat stones. The more or less round field stones are of no value in this type of garden, for they cannot be laid to drain the moisture into the interior of the mound. Flat material, on the other hand, can be laid to tilt back so that the rain will seep to the plant roots instead of dripping off the outer edges of the rocks.

Mark out the outline on the ground in the spot selected—preferably in a corner or with a background of shrubbery. Lay the larger pieces first, and build up in irregular contours. The more haphazard the arrangement appears the more attractive it will be when grown over. Shovel in rich soil as you go along, taking care to have a substantial layer between each rock and see that there are no air pockets. It is not necessary to pack the soil, as it will settle after the first rain or sprinkling. If available, add leaf mold or vegetable compost, or some barnyard fertilizer to the soil. Here and there two or three soil pockets can be built up on the peak of the mound to receive especially choice plants.

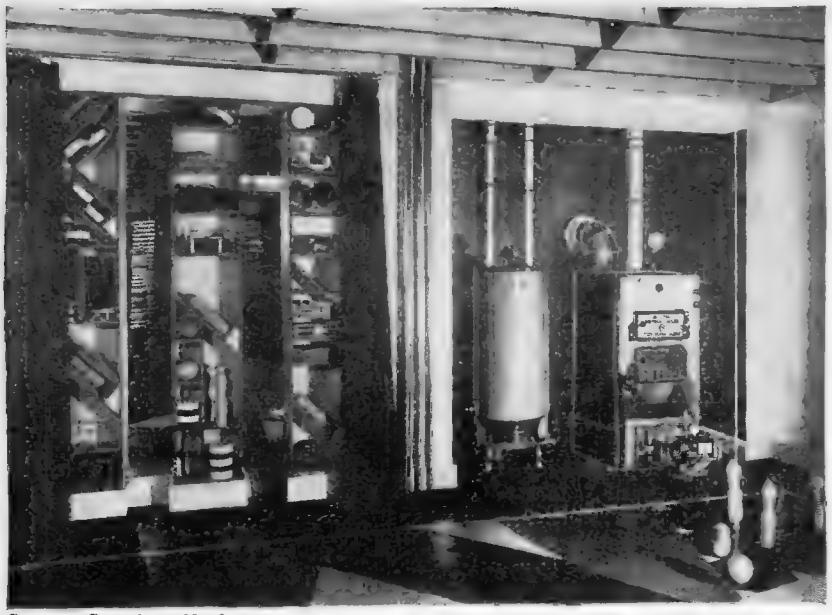
A loose gravel walk around the edge prevents the hardier grasses encroaching upon the rock plants, and sets off the garden to good advantage.

Choice of plants includes a great variety suited (*Continued on page* 465)

Summer Comfort *in* Winter Homes

By S. Gordon Taylor

Research Specialist in Home Planning



Courtesy Congoleum-Nairn, Inc.

This basement playroom tells its own story of the cleanliness of the oil burner and gas water heater.

This is the seventh article in our Home Improvement Series by S. Gordon Taylor. The first, which appeared in our March issue, dealt with Basement Improvement; the second (April) covered Insulating the Home; the third (May) dealt with Roofing; the fourth, (June) was devoted to Paints and Decorations; the fifth (July) to Bathrooms; the sixth (August) to Flooring. There will be an article on Electric Wiring in our October number, and also one on Fireplaces.

Courtesy Colonial Fireplace Company

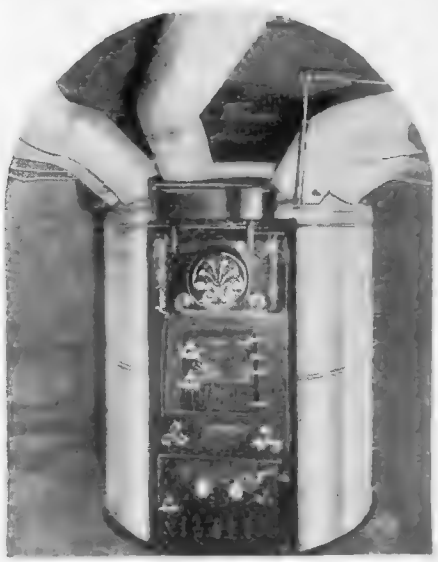
A fireplace functions as an efficient auxiliary heater and adds to the charm of a room; when properly constructed it will provide considerable heat without smoking.

WHILE a great many men find real pleasure in doing odd jobs around the house and in doing the outdoor chores, summer and winter, there are very few who enjoy the work and trouble required by the average heating installation.

Almost every home owner has an idea that sooner or later he will make changes in his heating system, which will eliminate some of its present drawbacks or decrease the time he has to spend upon it, yet year after year passes without the anticipated improvements being made. Sometimes the pocketbook will not permit a change, but in many instances the failure to take advantage of modern advancement is the result of putting the matter off from year to year, or may be due to ignorance of the fact that manufacturers now offer heating equipment and accessories which come very close to the ideal. With the modern equipment available, any existing plant, if it is basically correct, can be readily adapted to modern methods, and will give results comparable to those obtained with a complete modern installation. And this is the time of year to plan the improvements, so the job will be completed well before cool weather sets in.

The important and principal consideration in planning a new heating installation or in remodeling an existing system concerns the fuel to be employed. Of the three most common fuels—coal, oil and gas—gas is the most expensive, except in some sections of the country where natural gas is available. As to the relative cost of coal and oil there is much discussion. The answer depends largely upon location. Generally speaking, oil is considered somewhat more expensive than coal on the basis of actual fuel cost.

Fuel cost does not, however, represent the only factor of importance in selecting a fuel. The fuel that costs more per given unit of heat, may actually be the more desirable, because of greater convenience, greater comfort, greater cleanliness or other features, that can not be expressed in terms of dollars. It is often a fact that the most expensive fuels are the most convenient to use. Take electricity for instance. As a fuel its cost is so high that it is not considered practical. It nevertheless represents the closest approach to the ideal heating agent. (*Continued on page* 447)



Courtesy Richardson & Boynton Company

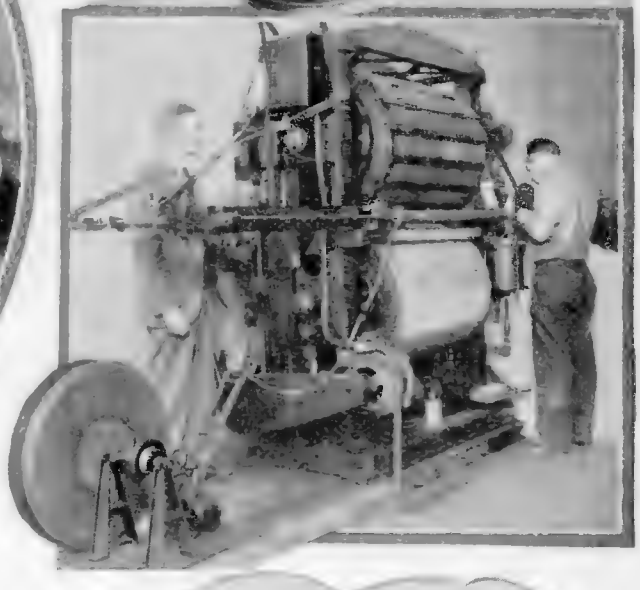
This warm air heater is equipped with an automatic humidifier, and furnishes proper humidity without special equipment or attention.

¶ Science and Invention's Home Service list of building manufacturers' literature will be found, corrected to date, on page 446 of this issue

Los Angeles—

In sinking oil wells drillers deviate as much as 1,400 feet from a perpendicular line. A Los Angeles inventor has produced a camera using ordinary cinema film which detects any deviation and enables oil men to drill their wells straight. The camera is loaded and lowered in a steel case into the hole. On the way down it photographs the reactions of a compass and bubble every ninety feet of the descent. The photographic record shows the angle of the hole and its direction.

Another Los Angeles inventor has contrived a globe which is also an effective atlas. The average globe of this size carries 2,000 place-names. But through two magnifying windows in the Los Angeles globe one may bring to light 42,000 place-names, and comprehensive data on population, industries, latitude and longitude, products, exports and imports—in all, about 200,000 words of useful information. The strips containing the data are printed on the press below, the only one of its kind in the world. It prints a strip 10,000 feet in length.



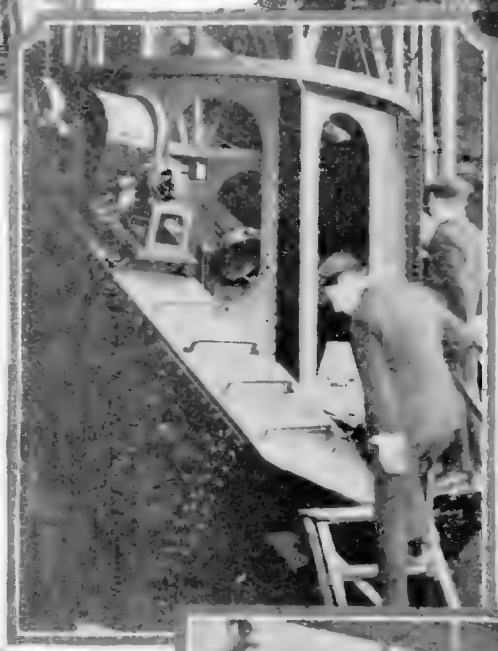
Left—The Los Angeles Produce Terminal, where concessions are rented at cost, reducing cost to consumers.

Right — The California Institute of Technology at Los Angeles, where Dr. Robert H. Millikan carries on his investigation of the atom and the cosmic ray. Dr. Millikan's work has been watched by scientists all over the world.

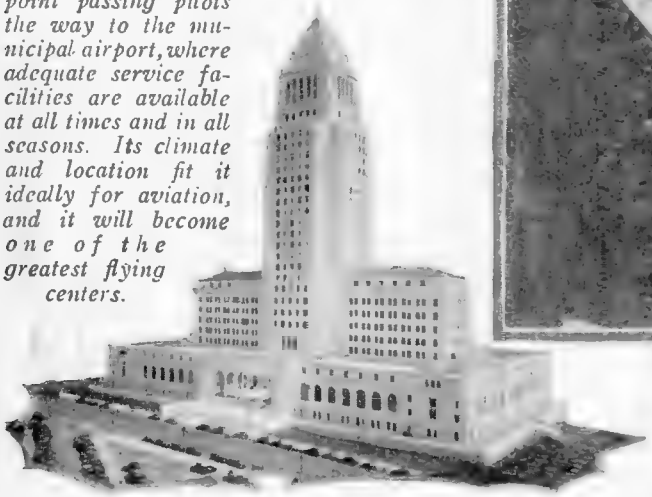
The Maddux Airlines were one of the very first systems established for regular passenger transport in the United States. They started off auspiciously with tri-motored flying equipment, and have continued to operate on regular schedule. They are one of six systems terminating at Los Angeles.

A Scientific Glimpse

Left—Smithsonian Institution Observatory on Table Mountain, near Los Angeles, one of the three in the world where the sun is observed to correlate findings regarding its effect on the weather. The other two stations are in Africa and Chile.



Above appears the dome of the great astronomical observatory at Mt. Wilson, often mentioned in connection with astronomical matters in the columns of this magazine. . . . Left—The famed Hooker telescope at Mt. Wilson, which has a 100-inch reflector and is the largest, to date, in the world. A story on reflectors made by a new process, which may increase the possible dimensions of such reflectors to 200 inches, appeared in this magazine in August.



Los Angeles' beautiful modern city hall has a tower 482 feet in height. At its very peak are mounted two aero beacons. One, the Lindbergh beacon, revolves continuously as a night marker for flying men. The beam of the other is fixed to point passing pilots the way to the municipal airport, where adequate service facilities are available at all times and in all seasons. Its climate and location fit it ideally for aviation, and it will become one of the greatest flying centers.

To the other gifts which nature has showered on Los Angeles, add oil. The oval shows oil wells in the vicinity of the city. In pits of pure tar—the La Brea pits (see foreground)—have been found large numbers of fossils belonging to prehistoric animals that once roamed this part of the coast. . . . Below—The home of the famous Lockheed company, maker of champion monoplanes.

Above—Fossil remains of animals dug from the La Brea pits, Los Angeles County Museum. They include an imperial elephant, a saber-toothed tiger, and a giant sloth.

THE meteoric growth of Los Angeles fortunately has been balanced in its proportions. . . . Industry, commerce, art, education, and science have sprung up side by side and have gone forward and expanded evenly. . . . And luxuriantly! Seldom has a more splendid stage been set for a more splendid scene. On these pages one sees Los Angeles' achievements in science, both pure and applied, by both individuals and groups, graphically represented.

Irving Air Chute Co., Inc.

A veteran air force sergeant of the old school offers a final admonition to three students about to make their first jump with Irvin chutes.

Traveling— Straight Down!

THE art of parachuting has never qualified as a method of soothing weak nerves, no matter how purposefully it has been practiced. But it is a fairly safe bet that no member of the well-famed Caterpillar Club ever registered a more thumping thrill than did the unknown who involuntarily treated the world to its first parachute jump, in a 'chute created impromptu by chance and the workings of nature.

Folks talk of lucky breaks. Here was a break that makes most lucky breaks seem the fruit of arduous planning on the part of painstaking beneficiaries.

It took place near Paris something more than 150 years ago. A French gentleman whose name has been lost to history was performing what was then a rare and reputedly foolhardy feat—an ascent in a hot-air balloon. Filled to the limit of its capacity, the inflated globe carried him skyward at projectile speed. Then, suddenly, the watching crowd saw a burst of smoke where the bag had been, and the aeronaut in his basket began a spectacular descent to earth. The lessening pressure of the atmosphere had permitted the balloon to explode.

G. P. Putnam's Sons

Beneath his Russell lobe, this jumper lowers himself gently to the bosom of Mother Earth.

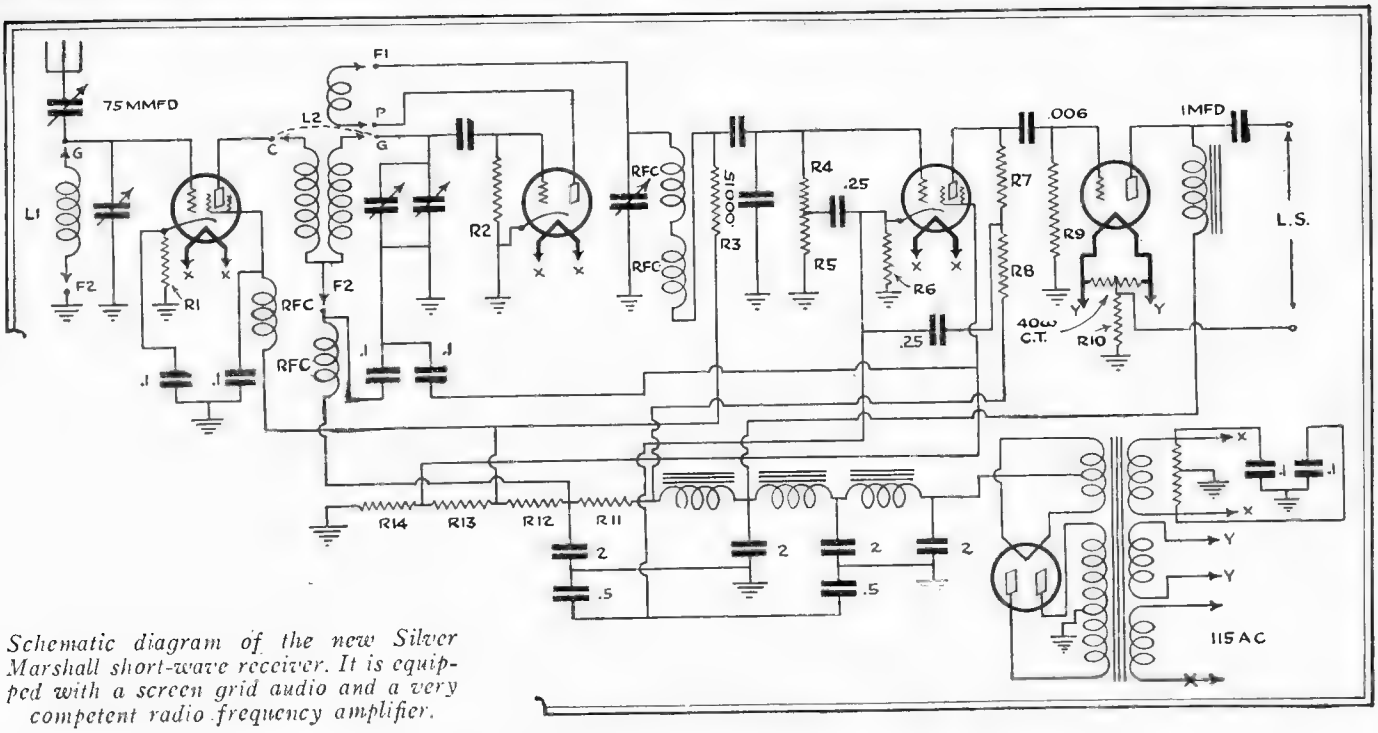
G. P. Putnam's Sons

In the old days, aeronauts went aloft in ships with lots of trimmings. Note the sails, the sweeps, and the complexly braced 'chute hanging beneath the basket. Like the girls, modern parachutists avoid stays, which present much resistance but don't add to safety. . . . At the left is shown an immense "valve" chute developed by Jimmy Russell for the Air Service. It is intended to lower a plane bodily to earth.

Faster and faster the basket and the terror-stricken balloonist sped earthward. But at some distance above the ground the fabric of the bag, blown by the upwash against the corded canopy, formed an inverted cup and began to check the progress of the supposedly doomed craft. In the end the skipper in his basket was lowered to earth so gently that he was not hurt in the least.

Whether the chief actor in this hair-raising performance bowed graciously and let on that it was all included in his act—that is a matter for conjecture. But it is known that he built his next balloon with a relief valve and repeated by plan the parachute drop which he had learned by accident. He repeated it many times, in fact, and never missed out on his turn. He died finally of the smallpox, in bed.

In 1797 another Frenchman, Andre Jacques Garnerin, operated successfully a parachute constructed as a separate unit and attached to a balloon. Five years later he made a descent in this 'chute from (*Continued from page* 464)



Schematic diagram of the new Silver Marshall short-wave receiver. It is equipped with a screen grid audio and a very competent radio frequency amplifier.

Build a BEARCAT Short-Wave Receiver

Want to Get London? And Paris? You Can with This Set. For Success in Tuning in Short-Wave Foreign Broadcasters and Television Signals Depends Largely on the Design and Construction of the Receiver Used

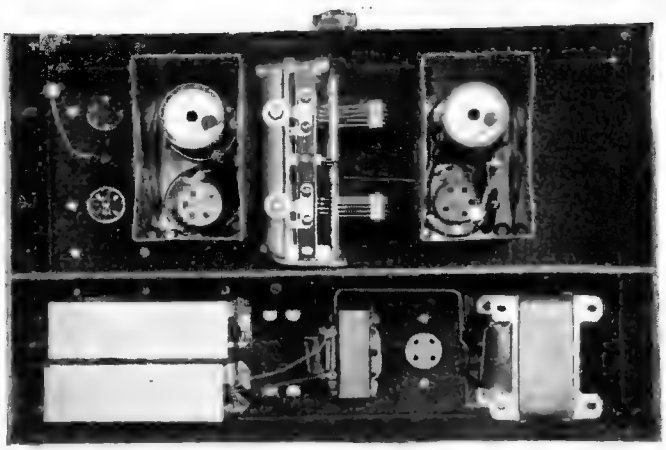
By J. E. KNOTTS

Engineering Department, Silver-Marshall Co.

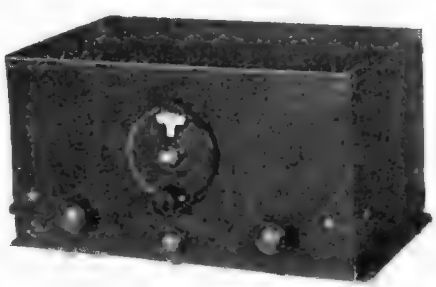
CONVENIENCE of operation and performance which can only be obtained with two-tuned circuits are combined in the new short wave Bearcat Silver-Marshall 737 receiver. Here for the first time in a production short-wave receiver two main tuning condensers are operated with a single control and the advantages of all a.c. operation are maintained.

In the Bearcat the receiver is tuned to some station near the middle of the band to be covered, after which the antenna coupling condenser, which also acts as a trimming condenser for the radio frequency stage, is adjusted for maximum signal strength, and left in this position. If this adjustment is made, with the vernier or "band spreader" in the detector stage, near its middle position, a small band may be covered by tuning only the "spreader." For the critical tuning required for 'phone stations the spreader is invaluable, and it and the regeneration control may be operated simultaneously.

The loading or padding effect of the antenna coupling condenser which permits it to be used as a trimmer will be understood by glancing at the illustration which shows the equivalent circuit



The placement of parts and tubes permits compactness with no loss of efficiency. Below, the Bearcat receiver.



for the antenna and radio-frequency tube input circuits. The effective inductance, capacitance and resistance of the antenna are represented as a dummy antenna, DA; the coupling condenser as C1, while LC, and C2 represent the tuning inductance, capacitance and the tube input capacitance respectively. The inductance of the small antenna ordinarily used for short-wave reception can be neglected so the principal effect of C is to tune L and C1. This circuit is broad enough so that misalignment between it and the detector circuit, which occurs in practice in tuning over the whole range, permits at least some signal to be received, after which it can be resonated for maximum signal strength.

In short-wave receivers it is extremely important to minimize the coupling between the radio-frequency and detector stages. If all circuits are perfectly isolated so that the only coupling is obtained through the radio-frequency tube elements, this coupling capacitance will be in the order of .01 mmfds., in the case of the -24 tube. This is much lower than even that of the -22 tube, but, because of the very high frequencies involved, the coupling through it is about equal to that obtained through the -01A or -26 tubes at broadcast frequencies. This coupling limits the stage gain that may be gotten in the radio-frequency stage to between about 4 and 40 over the range of from 20 to 200 meters.

The electrostatic shielding between the tuning circuits is shown in the top view of the Bearcat. This also shows the shield between the power section and the (*Continued on page 462*)

First Prize—$100.00
Mrs. John W. Bowman
Anaconda, Montana

Second Prize—$60.00
Mrs. R. E. Buser
Mount Morris, Illinois

Third Prize—$40.00
A. P. Kane
Bloomington, Illinois

Above—The basement recreation room in the Bowman home. Note the space-saving spiral staircase of wrought iron and the attractive fireplace.

Top of page—The other end of the Bowman basement recreation room. Circle — The Bowman home, an English cottage type.

Prize Awards in Basement Improvement Contest

Fourth Prizes—$20.00 Each

J. L. Barth, *Lancaster, Penna.*
Mark Beam, *New York City*
Allan Cunningham, *Coatsburg, Ill.*
M. E. MacLeod, *Augusta, Me.*
Jerome Bachman, *San Francisco, Calif.*

Fifth Prizes—$10.00 Each

Mrs. Zula Gambert, *San Francisco, Calif.*
Angelo Cohn, *Minneapolis, Minn.*
E. A. Hungerford, *Harmon-on-Hudson, N. Y.*
Mrs. Alice Haislet, *Steubenville, O.*
Donald Parker, *Scottdale, Penna.*
Herbert L. Bush, *Livermore, Colo.*
Floyd Sheppard, *Wayland, N. Y.*
Howard F. Kammerer, *Ottawa, Ill.*
R. W. Hatcher, *Milledgeville, Ga.*
Helen C. Barton, *Two Harbors, Minn.*

How We Utilized Our Basement

By Mrs. John W. Bowman
First Prize Winner

BEFORE I was married I lived in a large house with an eight-room basement — all waste space — a basement made dirty and dusty by a coal furnace. When I was married and planning a new home I was determined it should not have any waste space, and furthermore, that it should be practical and clean.

Of course, the only way to have a clean basement is to have an oil furnace. No matter how careful a coal-deliverer is, or how closely one watches him, there is coal dust that settles in every spot and even drifts or is tracked upstairs. It is a constant nuisance that tries the patience of a busy housewife. So we installed an oil furnace. The result is we practically live in the basement. The upstairs is always neat and in order for unexpected guests and casual callers, and the basement shows we do enjoy life.

Our house is of English cottage type —one floor above ground. There is a back stairway from the kitchen to the laundry, and from the living-room in front is a wrought-iron circular stairway to the recreation room in the basement. The idea of the circular stairway was to save space, and it had to come from the living-room as it was a last-minute thought in the building process. It is painted red with black rubbed over it to make it look antique, thus blending with the atmosphere of the pine paneled living-room. This stairway makes the recreation room easily accessible and is a convenience we couldn't do without.

In the recreation room my husband has his desk and I have mine. There is a radio and phonograph, a card table and four chairs to match, always up and ready, a day-bed in case we need an extra bed-room, and a brick fireplace about eight inches from the floor which is different and throws the heat more where it is wanted.

This room is always a surprise to anyone looking at the house and our friends

(*Continued on page* 466)

High Points *in the* Basement Improvement Contest

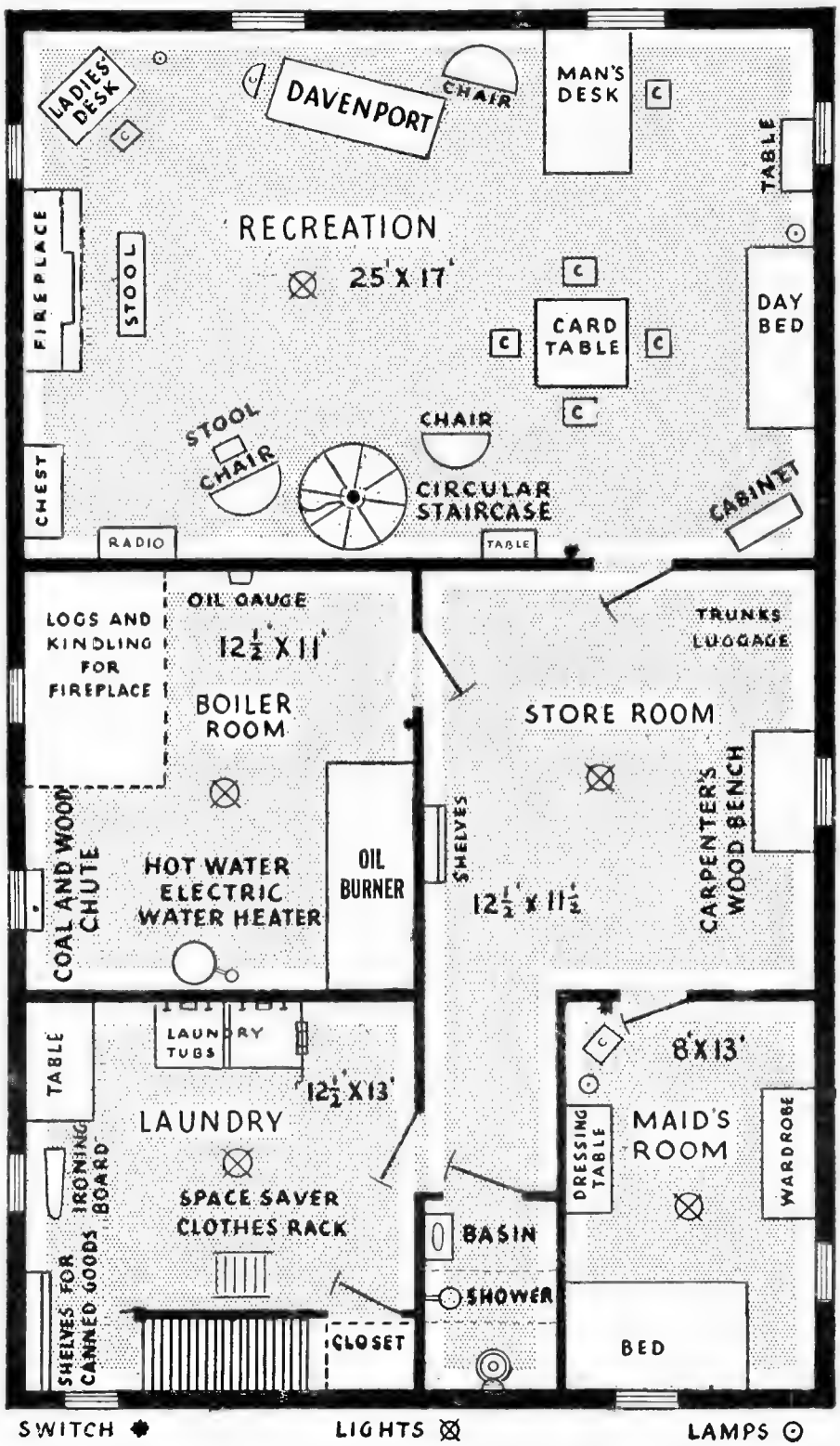
TWENTY-SIX states, Canada, and the Philippines were represented among the 86 plans reaching final consideration in SCIENCE AND INVENTION'S Basement Improvement Plan Contest, which officially ended on May 31, 1930. New York State led with fourteen entries. California came next, with twelve. Pennsylvania scored third, with nine. Illinois and Minnesota followed.

Out of so many excellent entries it was no easy task to select the eighteen winning plans, and afterward to decide which of the eighteen would rate highest. However, after painstaking consideration, the judges, Messrs. Leland Hubbell Lyon, Louis C. Stone, and S. Gordon Taylor, found themselves in perfect agreement.

Of outstanding interest is the fact that of the 86 entries reaching final consideration, 27, or practically one-third, were submitted by women. It will be noted too that women won two out of the three highest prizes. The percentage of women entrants among the prize winners was less than their percentage among the entries reaching final consideration—something more than 27 percent. On the other hand, their percentage of the prize money ran considerably ahead of their percentage of numerical strength, not only among the prize winners but among the total entries. They came off with $190.00—better than 47 percent of the prize money offered by this magazine.

SCIENCE AND INVENTION is pleased at the widespread interest aroused by its Basement Improvement Plan Contest, and pleased with the valuable practical examples of basement utilization which the contest has made available. In our October number we shall take up the plans which were considered second and third best by our judges, and in the November number we shall consider the other winning plans and also discuss the story told by the winning entries collectively—including the percentage of utilizations for recreational, workshop, playroom and other purposes, proportion containing certain types of equipment and other interesting facts.

Particularly gratifying to the editors was the interest shown by our readers in the Home Service List of Building Materials Literature. Nearly 5,000 requests for this helpful information were received by this office in the three months of the contest. To make this list available to those who have not yet made use of it, we are publishing it, with additions, in the present number of SCIENCE AND INVENTION.



Here is a redrawing of the complete basement plan submitted by Mrs. John W. Bowman, winner of First Prize in SCIENCE AND INVENTION'S *Basement Improvement Contest. . . . Note that in this home, a story-and-a-half in height, intelligent utilization of space and modern equipment has produced roominess, comfort, convenience, and charm in a degree superior to that found in many houses far more pretentious. The function of storage has been assigned to a single room; yet through orderly arrangement the storage facilities are ample, and space is available for a small workshop in the same section of the house. An electric heater makes it unnecessary to operate the oil burner for hot water purposes in the warmer seasons. The end of a hall has been cleverly used to provide a shower bath, lavatory, and toilet.*

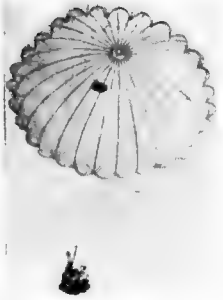
The way I see it—

By Murray Godwin

The Borderland of Science

FROM one contemporary publication we receive a pair of reprint sheets carrying a skeptical consideration of the movement (if any) to make sociology an exact science. From another we receive a copy of the regular issue containing a graph, on which rising and falling lines indicate the height and duration of the world's civilizations since 3600 B. C. . . . The article first mentioned treats sniffishly the tendency of sociologists to overlook the unpredictable human factor. The graph, with which in the main we find no fault, shows us that the human factor so nearly equals zero that it cannot raise a single minute extra hump in a given cultural line. . . . Moreover, the graph supports in considerable measure the case for exact sociology. It strongly hints, for example, that civilizations which draw their sustenance from marine commerce (Greece, Rome) make altitude records and then go abruptly into tailspins, perhaps because their angle of attack is too acute; while civilizations which draw their income principally from agriculture (China, India) level off, under pressure, into long glides. . . . It is our conviction that sociology can be an exact science, provided the sociologist can gain a position from which the trees do not obscure the woods. Which, of course, is no easy job. Bacteriology must be a desperately inexact science—to a microbe. . . . One defect we note in the graph offered by our contemporary is that it lumps the achievements of modern Europe and America and plots them in a single mounting line. We think the graph would be more accurate if modern civilizations were identified with political divisions as are those of ancient times. . . . Another quibble: The graph is accompanied by the query, "Will our place be permanent?" Since our civilization incorporates in its foundation the very practical and utterly uneconomic factor on which were based the fallen civilizations of yesteryear—to wit, conquest—it is certain that we shall join them presently. . . . Do you want to live forever?

Planeless Flight



Irving Air Chute Co.

TWO BOOKS ON PARACHUTING have come our way of late—*Parachute*, by Charles J. V. Murphy (G. P. Putnam's Sons), from which our story of 'chute development, found elsewhere in this issue, has been taken, and *Jump*, by Don Glassman (Simon and Schuster). . . . The latter volume is mainly a series of dramatic stories, gotten through reports and by word-of-mouth from the Caterpillar Club. The former is a historic narrative of the development of the parachute. . . . Mr. Glassman has a yen for embellishing his Caterpillar reports with suns that are "discs of hammered brass" and jumpers who turn over and over "like flipped coins"; and this gift especially fits his stuff for serialization in the newspapers. Mr. Murphy's story tends to revolve, without relevant garnish, around the men who actually developed the aerial lifesavers of yesterday and today; and I find his book more readable as well as more informative generally than the other. The Murphy book scores heavily in explaining the problems of parachute design, and adequately covers the work of Jimmy Russell in developing the "lobe" form—a matter ignored by Mr. Glassman, who neglects also to impart any definite idea of what Major Hoffman and the Army Parachute Section accomplished at McCook Field after the War. . . . Nevertheless, the Glassman volume is interesting within its limits. If you are curious to know things about 'chutes and what has been done with them, you probably could read both books with profit. . . . Don't look for entire agreement in facts, however. Glassman has Leslie Irvin building the first Model A army 'chute, designing the harness himself, and coming forward to try it out in April 1919. Murphy has the 'chute built complete by the Parachute Section at McCook Field; Irvin appears about the middle of May and makes the jump a few days later—leaving an interval hardly sufficient for building a first model and designing a harness. What these opposed versions indicate is not clear to me.

History, Encyclopedia, Handbook

Western Electric Co., Inc.

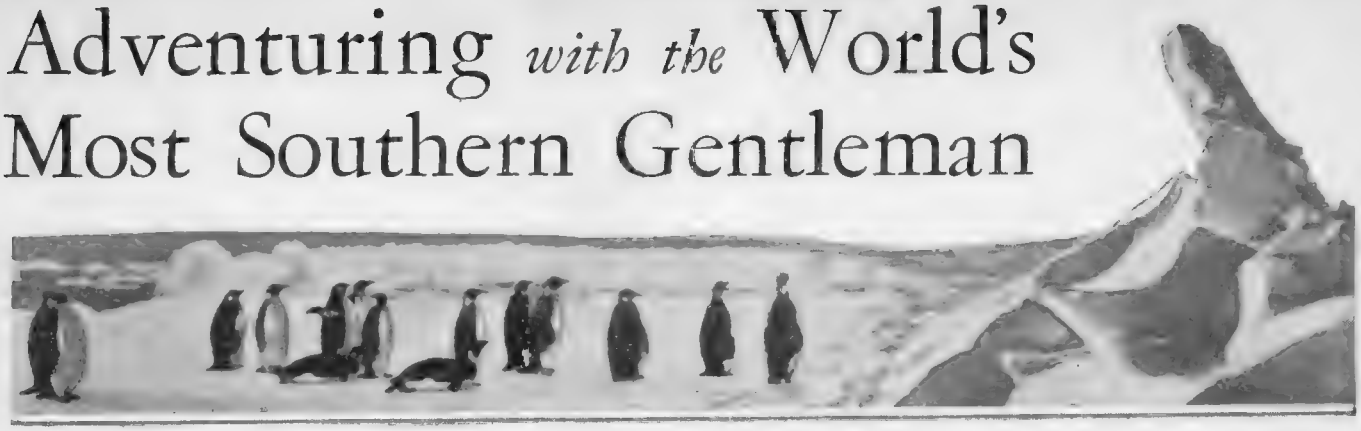
THE BRITISH VIEWPOINT is altogether too plainly visible to a Yankee jingo like myself in the revised edition of *Conquering the Air*, by Archibald Williams (Thomas Nelson and Sons). . . . The Spirit of St. Louis holds forth on the jacket, and Lindy appears on the frontispiece; but Lindy's New York-Paris flight is classified, with calm British obtuseness, under the chapter heading, "*More* Trans-Atlantic Flights," the inference being that the Colonel's feat was a rather distinguished trip over the trail blazed by the Vickers-Vimy bomber of Alcock and Brown. The difference between a hop from the farthest edge of North America to the nearest edge of what may technically be described as Europe, and a hop which takes in a distance almost equal to the ocean jump before it reaches the ocean, which must be continued for some hundreds of miles after the ocean has been passed, which had to begin and end at definitely specified cities, and which was accomplished by one young pilot—against the two veterans who made the other. . . . This difference, to the English mind, is quite obviously favorable to the pond-jumpers in the Vickers-Vimy. . . . That is perhaps the outstanding piece of stupidity in a chronicle replete with Union Jackassery. . . . There is also an outstanding error in date—a parachute jump by Lieutenant John A. Macready is dated June 19, 1914. The Caterpillar roster gives it as June 18, 1924. Also, I must note, Lindbergh is pictured as having fitted himself for long, lone flights by piloting air mail planes across the Rocky Mountains. If this is true, which it is not, the Rockies are a lot more restless than I had thought. Lindy's old route, if I must remind you, extended from St. Louis to Chicago. . . . *Everyman's Book of Flying*, by Orville H. Kneen (Frederick A. Stokes Co.), aims at being a "condensed encyclopedia" of the air. It offers the layman an answer to the Why and How of aviation, from meteorology and navigation to aerobatics and engines. It shirks no technical explanations necessary to imparting a true idea of flight in its many phases. Its scope is comprehensive and its content well arranged for reference. There are chapters on service and repair and training for pilot and mechanic. . . . Alexander Aircraft publishes *Modern Flight*, by Cloyd P. Clevenger. This little book covers in simple straightforward fashion the technique of plane manipulation in flight. A section by Chief Mechanic Joseph Leonard of the Alexander Airport gives helpful hints on engine care and repair.

Go-Getter

Telephone Review

JOAO FIGO was discharged by a Brazilian telephone company as being "a little weak for the work required." But Joao had learned a lesson from the busy bee. At a town where a telephone line was scheduled to be built he represented himself as a construction superintendent, gathered a gang and supplies, and for ten days erected poles along a line cleared through the jungle. The telephone company applauded his workmanship but damned his judgment. The line of poles, ten miles long, extended in a direction precisely opposite to that designated in the plan.

Adventuring *with the* World's Most Southern Gentleman



Senatorial penguins were the welcoming party for the Byrd expedition to the South Pole. Plenty of ice, of course. Some seals, some whales, but mostly ice, snowy peaks and more ice.

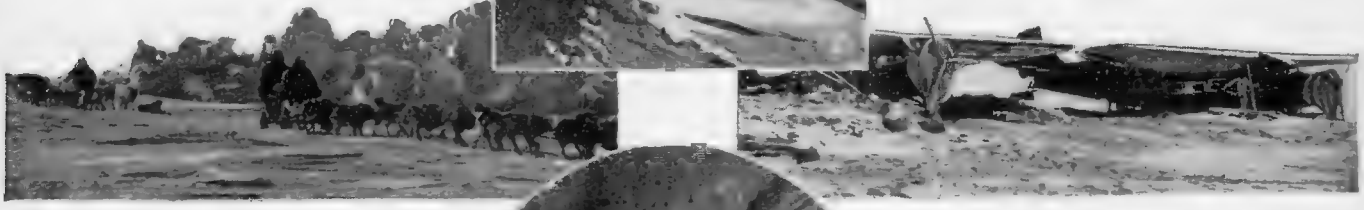
Just 300 yards from the settlement at Little America these huge whales raised their ugly snouts through an opening in the ice. Note closeness of expedition members.

A couple of the members of the expedition having a little fun with Papa Seal while they hold Mama Seal. Papa does not seem to enjoy the event and registers disgust.

Dr. Lawrence Gould, geologist, looks at the wreck of the tri-motor Fokker, which was picked up by a howling blizzard and carried a half-mile, with the illustrated results.

A dog team sets out to establish land posts as emergency landing stations for the flight to the South Pole. Caches of food were erected as in the center illustration.

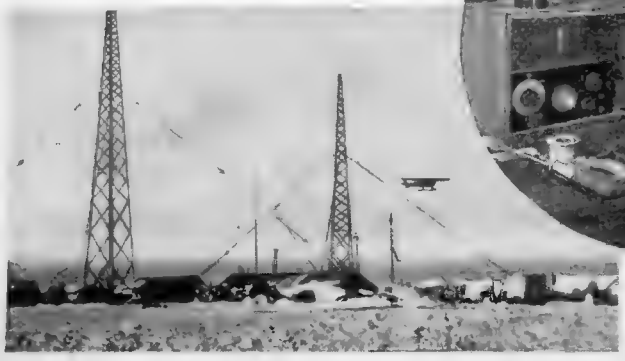
Two of the Byrd planes resting at their landing station. One was later destroyed by a blizzard of unimaginable fury. The wrecked plane is seen above.



Steel radio towers of the Little America station, with plane circling over the settlement.

Haines, radio operator.

Ice formations such as these give much interesting scientific data to Dr. Gould, the expedition's geologist.



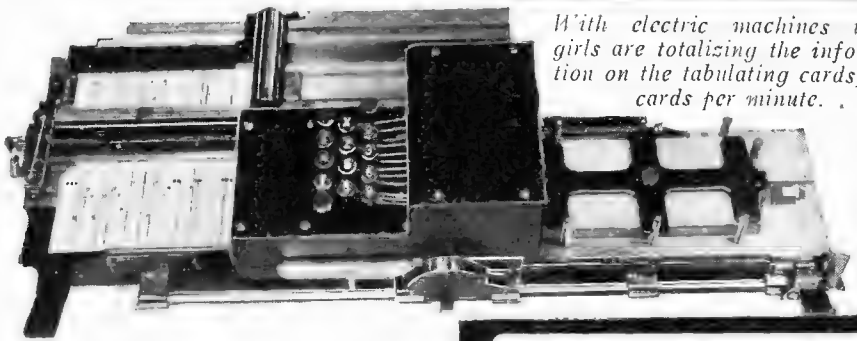
Electric Fingers Count Our Millions

By O. E. Braitmayer

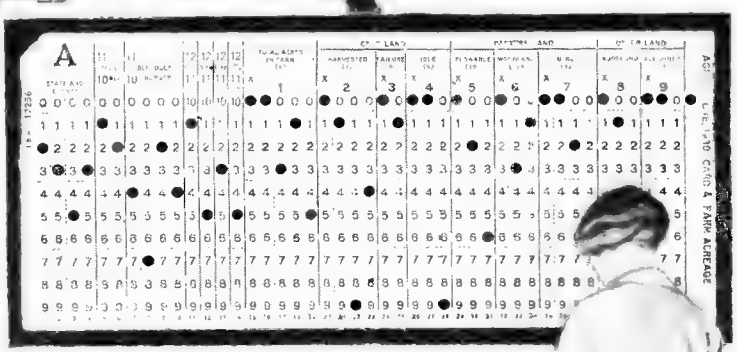
Vice President of the International Business Machines Corporation.

With electric machines these girls are totalizing the information on the tabulating cards, 150 *cards per minute.*

FOR the greatest statistical undertaking ever attempted, the 1930 United States census, more than 400,000,000 tabulating cards will be used, and hundreds of duplicating key and automatic gang punches, horizontal sorting machines which operate at a speed of 400 cards per minute, electric tabulating and accounting machines which simultaneously work 750 combinations will keep going constantly.



Duplicating key punches, like the one above, automatically punch common data.



After the information has been key-punched, the cards are classified by horizontal sorting machines at the rate of 400 *cards per minute.*

BEEHIVE activity fills the eight vast wings of the Bureau of the Census in Washington, where Uncle Sam is compiling billions of facts in the Fifteenth Decennial Census.

It's a big job . . . the greatest statistical undertaking the world has known. And only scientific invention, applied to a mechanical means of tabulation of the data, has made it possible of achievement within a practical time limit. The punched-hole method of electric tabulation invented by the late Dr. Herman Hollerith, and first used in the Census of 1890, provides the speedy, efficient and accurate means of tabulation that the Census Bureau must have. Of the four main subjects of the census, Population, Agriculture, Manufactures, and Distribution, the greatest statistical task is that of Agriculture.

The Agricultural Census involves compiling a multitude of facts about 6,500,000 farms, including comprehensive information regarding some 100,000 irrigation and drainage projects.

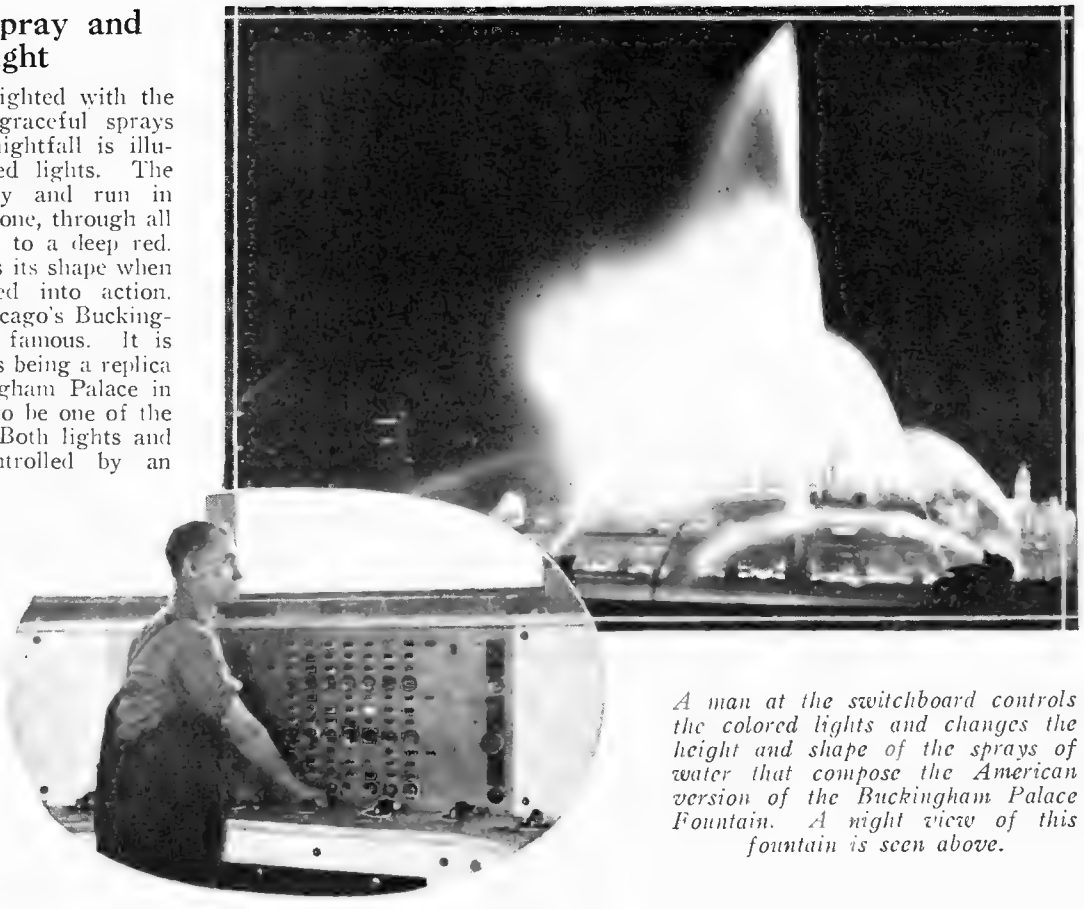
Information recorded by the census enumerator on the General Farm Schedule is transferred to tabulating cards by means of punched holes. These tabulating cards, 7⅜″ by 3¼″ in size, are divided into a number of sections, or groups of columns called "fields," and there are twelve possible positions or points in each column, and each position in a column represents a certain fact. For example, the General Farm Schedule shows that "John Smith" is a white owner. This is transferred to the tabulating card by means of a punched hole in the first position of the eleventh column.

Punching the data of the Census of Agriculture is performed by electric duplicating key punches. The holes are made by the action of an electromagnet when a key is depressed. Data common to a number of cards, such as area in which the farm is located as state, county, and civil division, are automatically punched. Individual information is recorded by the operator.

Assuming that the cards have been sorted according to area, such as state, county, and civil division, it may be desired to know respectively the number of white owners, colored owners, white renters, and colored renters in Kiowa Township of Pittsburg County, Oklahoma. The electric sorting machine is set to work on the eleventh column of the tabulating (*Continued on page* 465)

Symphonies of Spray and Colored Light

CHICAGO is again delighted with the constantly changing graceful sprays of a fountain which at nightfall is illuminated by myriad colored lights. The lights change continuously and run in blends from a deep violet tone, through all the colors of the rainbow, to a deep red. The fountain itself changes its shape when different sprays are called into action. While only a year old, Chicago's Buckingham Fountain is already famous. It is known all over the world as being a replica of the fountain at Buckingham Palace in England, and is conceded to be one of the loveliest in this country. Both lights and sprays are remotely controlled by an operator at a small switchboard. The switchboard is so situated that the operator can observe from a window the different colors and the height of the water. From this vantage point, he controls and blends the color of 500 lamps.



A man at the switchboard controls the colored lights and changes the height and shape of the sprays of water that compose the American version of the Buckingham Palace Fountain. A night view of this fountain is seen above.

In the Spotlight *of* Science

The *Deep* Is Certainly *Down* On This Musical Weapon

HOW would you like to hear your neighbor practicing on the world's largest saxophone? It is an E-flat bass weighing 34 pounds, and stands six feet seven inches in height. The bell is seventeen inches in diameter. The rod operating the low C-sharp key is 39 inches long. The low B flat tone hole is three inches in diameter.

Slot Machines Deliver Gas by the Can in Los Angeles

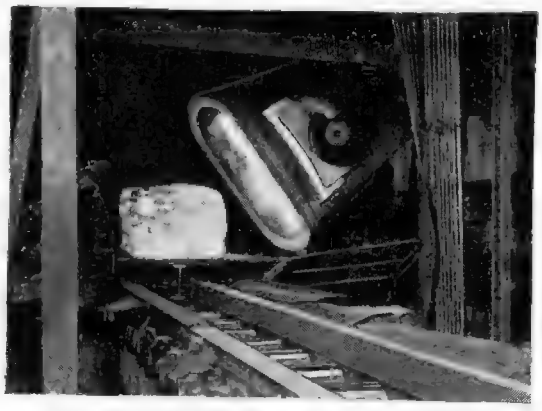
YOU have heard of gasoline stations that deliver a measured quantity of gasoline when a coin of any denomination is inserted in the appropriate slot. These stations are a boon to the motorist who has found that his gas supply is running low and that he must replenish his tank. Yet, up to the present time, no one has come to the aid of the motorist who in the dead of night finds that he has not enough gasoline to allow him to proceed to the nearest gas station. Now, thanks to the foresight of an ingenious inventor, the careless motorist will not have to worry, if he picks out Los Angeles, California, as the place to run out of gas. If he has fifty cents in his pocket, he walks to the nearest gas automat, deposits his money, pulls a lever and has a gallon can of gas delivered to him. This gasoline takes him home or to a regular supply station where his tank can be filled. The following morning he returns with the empty can and receives a refund which is the difference between the price of the gas and his deposit for the can.

Such systems can also substitute for garage-men on night duty.

Alice Doll, left, and Nita Pike, right, all gassed up and ready to go, at an emergency slot-machine fuel station.

New Process Bringing Old Metal Into Its Own

Above—Barges lowering the Spuyten Duyvil electrical ducts into the bed of the stream. Below—A ball of pure wrought iron weighing 2,700 pounds, produced by the Byers process.



WROUGHT iron, for years an outdistanced competitor in the metal market, is coming into wider use again because of a new method discovered for making it in large quantities without dependence on skilled hand labor — the element which once forced it into a minor position in the metal products field. Recently it was selected by New York Central engineers as the proper material for important electrical ducts beneath the waters of Spuyten Duyvil, which separates Manhattan from the mainland to the north.

Spuyten Duyvil is 600 feet across and its waters are salt. The ducts were necessary to protect all the high tension lines for the west side improvement of the railroad. Submarine cables presented the danger of fouling, and certain other kinds of piping did not entirely eliminate the chance of broken joints and leakage. The ducts had to be bent many degrees to fit the contour of the river bed, and the highly corrosive action of salt water had to be considered. Wrought iron seemed virtually to defy time and the elements, and was finally selected as being the best material for the purpose.

A total of 23,400 feet of wrought iron piping in the form of 36 ducts, each 650 feet long, was employed. The ducts were yoked with wrought iron bolts in four layers of nine lengths each. Filled with oil to facilitate drawing the power lines through them, the ducts were carried by barges to a position above a trench already dredged, and were lowered into its bed with the assistance of a diver, who guided the operations by signals from the trench beneath the stream. The operation was completed in less than a day.

The development of the Bessemer process was the factor that sent wrought iron into its eclipse, and the development of the Byers New Process by Dr. James Aston of the Carnegie Intitute of Technology is restoring it to an important place in the metal world.

Increased Turnover

AN automatic machine exhibited at the Food and Household Exposition, Los Angeles, produces flapjacks ready to eat at the rate of three a minute. It pours the batter, bakes the cakes on both sides, and flops them between times, all without human assistance.

Here is the machine that Paul Bunyan and his lumberjacks need to supply them with flapjacks as fast as they can absorb them.

Bacillus of Leprosy Isolated

THE medical profession has experienced many startling revelations of scientific achievement within recent years. Probably none of them, however, has proved quite as astounding for such basically sound reasons as the isolation of the bacillus of leprosy by Dr. Hermann Dostal, a Viennese bacteriologist. Everything about leprosy has baffled investigators for centuries. Its causes have been but vaguely identified. No treatment has been more than partially successful. Now Dr. Dostal has not only identified the cause but has devised a serum treatment.

Waste Hog Makes Breakfast Food for Boilers

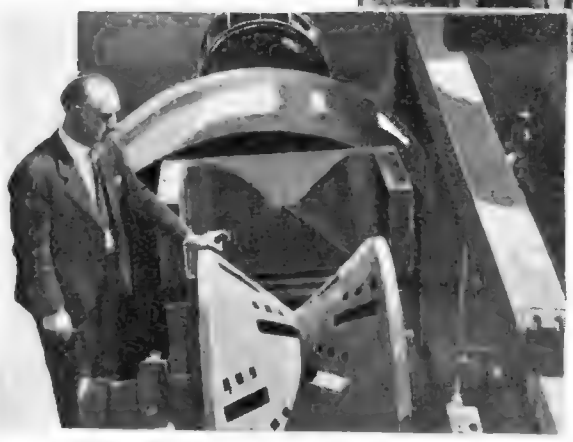
A "hog" for converting unusable scrap into sawdust is a part of every well-designed woodworking plant's equipment. Pasadena, Calif., has expanded the dimensions of the lumber industry's hog and is applying the resultant mechanism to the conversion of all sorts of wood refuse. The sawdust can easily be incinerated or blown as fuel into the furnaces of a steam power plant.

The hog consists mainly of a hopper into which the refuse is fed, and revolving jaws, located below ground level, which reduce the refuse to easily combustible form. The size and strength of the jaws permit them to grind up anything from twigs to tree trunks.

From three to four tons of refuse can be converted in a two-hour run by the Pasadena hog. Thus the rubbish can be handled as fast as it is collected, and unsightly dumps are made a thing of the past.

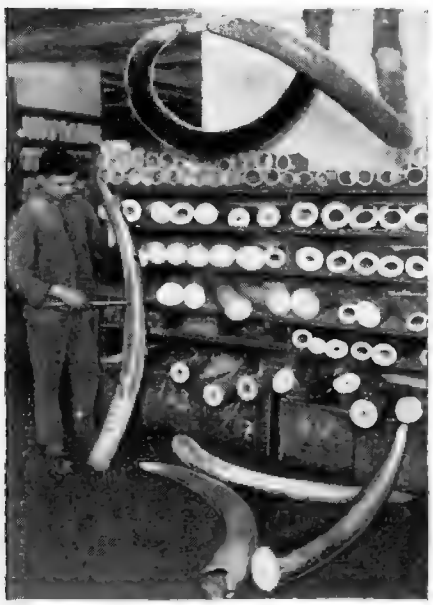
The jaws of the unit are driven by a 100-h. p. motor. As the refuse is converted to sawdust, it is blown by a ninety-inch fan through a duct 250 feet long to a cyclone (a conical receptacle) on the roof of the disposal plant, which serves as a reservoir.

At the right is an exterior view of the Pasadena wood hog's home. Note pipe leading to cyclone on roof. Brush is being assembled for disposal. Below—One of the hog's jaws, showing sockets for teeth; tooth on rail at right.



Methods of utilizing the sawdust produced by a wood hog are various. The most common is to consume it at once as fuel. Mines and sawmills often depend for a large part of their fuel supply on the sawdust coming from the hogging of scrap wood. Sweeping compounds represent another utilization, as does the traditional custom of sprinkling sawdust on the floors of butcher shops and certain other establishments.

Ivory Concentrate



These elephant tusks are classified and held in storage for manufacture into billiard balls and other products.

BILLIARD players and baseball team managers may be interested in this photo of an ivory storehouse in Berlin. All those white circles are the butts of elephant tusks, representing ivory just as solid as it can be found in its native state. The tusks are classified at this depot and stored until they are needed for the manufacture of various ivory products.

Suicidal Mania in Nature

TWO remarkable examples of a suicidal instinct in nature are provided by the lemming, a species of rodent found in the Scandinavian peninsula, and the tomcod, a fish spawning near New Zealand. The former breed for years in the Kjolen Mountains in Norway, and suddenly emerge in millions for a march to the sea, into which they throw themselves to be drowned. They are making one of their migrations this year, marching at night, hiding in the daytime, and devouring all vegetation in their path. Scientists are at a loss to account for the lemming death marches. It has been guessed that they are trying instinctively to reach some ancient feeding ground, which long since has been obliterated by changes in the earth's crust.

Though peasants, snakes, birds and other enemies take heavy toll of the lemmings on their march to the sea, the expedition always leaves enough survivors to bring the tribe up to marching strength again, in the course of years.

The tomcods likewise are a mystery to science. After multiplying and reaching a considerable size in the South Pacific, they migrate to the shores of America and, when frosty nights arrive in the Fall, fling themselves by tens of thousands upon the beach, wriggling until they are beyond the reach of the surf. Last year they were picked up in great numbers on the Rockaway beach, then packed and sold in Manhattan fish markets.

Finney, the Flying Squirrel

WITH a triangular sail forming an air resistant surface between his legs, Rex G. Finney of Los Angeles has added to the powers of the parachutist something of the directional gliding ability of the flying squirrel. Formerly the 'chutist could vary his course only by slipping the shrouds. Now he may change it simply by shifting his legs, presenting the sail at a new angle to the line of flight.

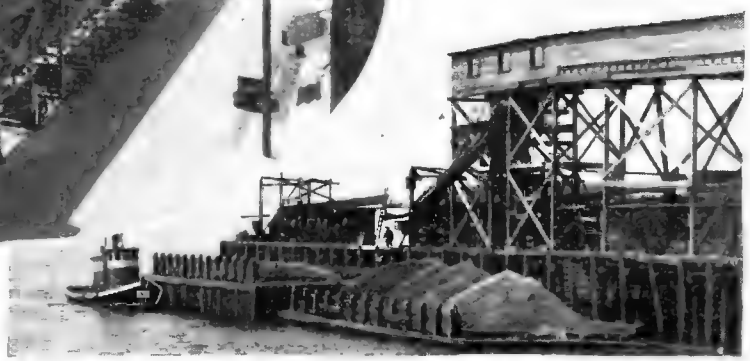
Moving a Mountain

Seattle is moving a mountain to the sea in stages. The mountain is continuously cut down and the material moves on endless conveyors through the city, pours into scows and is dumped into Puget Sound.

Ewing Galloway

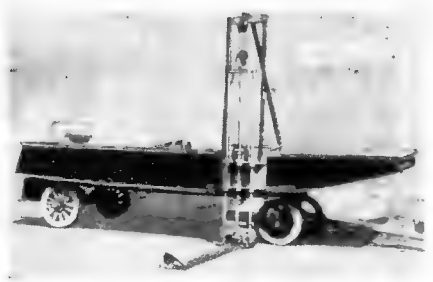
THERE is an old proverb that reads "If the mountain will not come to Mohammed, Mohammed will go to the mountain." Today the mountains go to Mohammed, and there is no miracle about it either. Out in Seattle, a city of hills, machinery is removing mountains and carrying them to the sea. A hill is cut away by an elaborate system of drills, scoops and shovels, and the dirt and rock are carried away by bucket belts and plain belt conveyors. The conveyors run straight through the city, and terminate at the waterfront, where the dirt and rock are dumped into scows. When a line of scows is filled, a tug tows them out beyond the limits of the harbor and the dirt is dumped at sea. And so we have a mountain that is actually being moved to sea, not intact of course, but in a continuous stream. The removal will make available an immense tract of land that is today practically useless for building purposes.

The photographs show three representative views of the seeming miracle. An idea of the immensity of the project can be gained by comparing the cutting mechanism and conveyor that hoists the dirt to the top of the hill with the men standing alongside. The oval shows the belt conveyor running through the streets of the city.



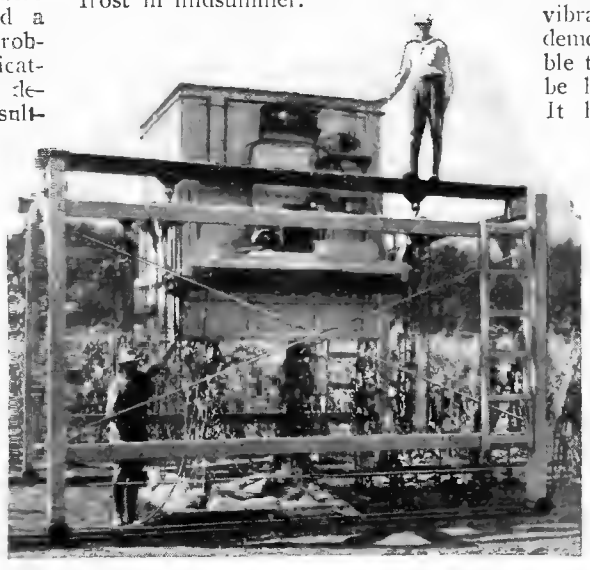
Machine Mows Submarine Meadows

A STRANGE craft that has been christened "The Lily Nipper" recently made its appearance and solved a rather knotty problem. A fifty-acre reservoir in Earlington, Ky., had a heavy growth of pond lilies. The problem was to devise a means of eradicating this growth. A machine was designed by L. V. Harrington, a consulting engineer of Louisville, whose firm undertook the job of clearing the lake. A flat-bottom scow was fitted with a mowing mechanism and both the scow and the cutter were operated by a thirty-five horsepower Universal motor. Between the cutter bar and the motor a Chevrolet clutch and transmission gear were inserted, so that the boat could be propelled without the action of the cutter. The cutter bar is adjustable for different depths of water, and can be made to extend to a distance of five feet below the surface. In the photograph one may observe how the carriage can be raised or lowered by a system of pulleys. The middle bar on the carriage is the cutter driving shaft.



Where Would You Like Your Frost?

FEDERAL scientists are testing the cold resistance of corn crops with a mobile refrigerator unit to determine the ability of various kinds of corn to withstand sudden drops in temperature. The refrigerator is mounted on stilts and casters and will produce an Autumn frost in midsummer.



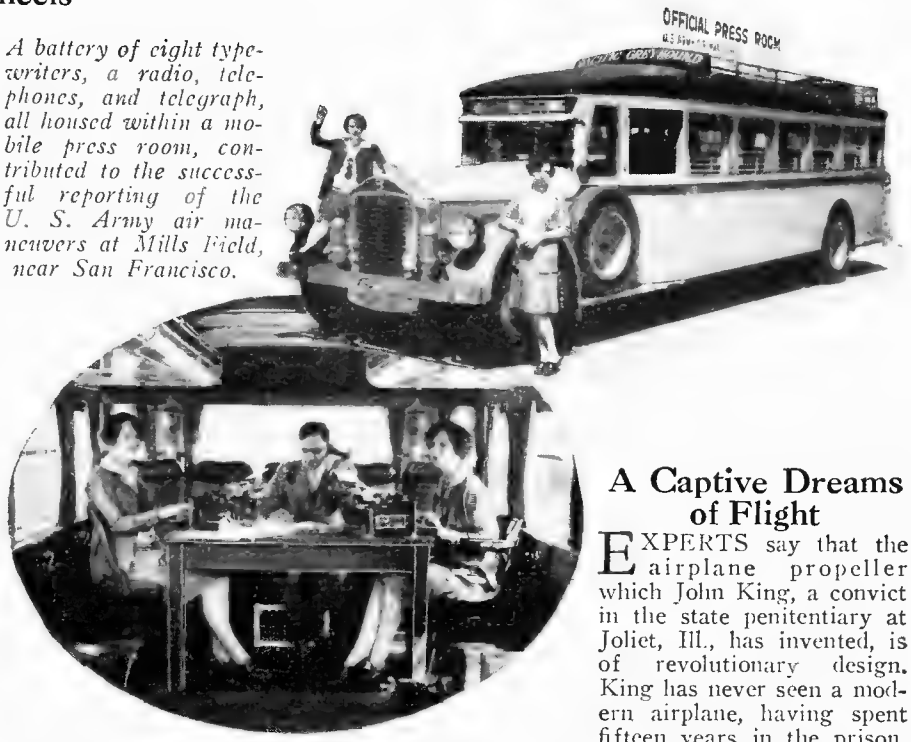
Sipping Music Through a Straw

A MECHANICAL device to enable those who cannot hear with their ears to hear with their teeth, was demonstrated at Ithaca, N. Y., by Prof. Frederick Bedell, of the Department of Physics at Cornell. Instead of genuine straws the guests at the demonstration held slender pieces of wood between their teeth. The sharpened end of a wood piece was held in contact with the vibrating mechanism. The inventor demonstrated that music almost inaudible to the ears of a normal person can be heard distinctly through the teeth. It has been estimated that approximately two-thirds of all people who are deaf can hear with an apparatus of this type.

Now we will let you in on a little secret. If Prof. Bedell had read SCIENCE AND INVENTION MAGAZINE, he would have found that his invention was not a momentous discovery. The cover illustration of this publication for the month of November, 1923, shows a device called the osophone, which consisted of a small improvised loud speaker in which a moulded grip attached to the vibrating reed, was held between the teeth. The principle of bone conduction was utilized.

Verb Factory on Wheels

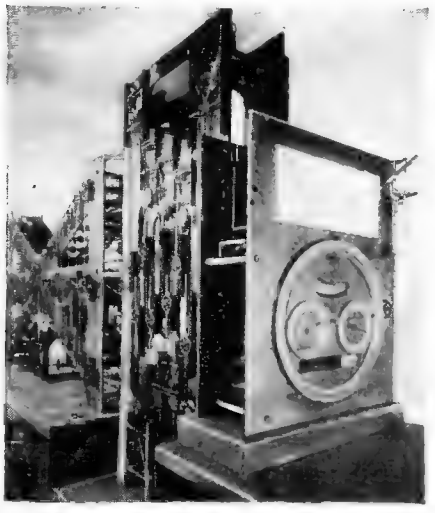
A HUGE and luxurious motor coach equipped with almost every known device for the efficient handling of press despatches, may frequently be seen speeding over California highways to some event of national importance. This mobile press room is claimed to be the first completely equipped vehicle of its kind in the history of journalism. It is provided with telegraph instruments, telephones, radio, and a battery of typewriters. Within a few moments, the telephone connections can be made available and ready for instant use. The motor coach is the property of the Pacific Greyhound Lines, Inc., and when not operating as a mobile press room it becomes a passenger coach. The interior fittings being interchangeable, it can be converted again into a press room at a few hours' notice. It was first used by reporters of the San Francisco Dailies in covering the series of sham battles which were part of the army air maneuvers at Mills Field, near San Francisco.—*Gilson Willets.*



A battery of eight typewriters, a radio, telephones, and telegraph, all housed within a mobile press room, contributed to the successful reporting of the U. S. Army air maneuvers at Mills Field, near San Francisco.

A Machine That Should Be Adapted to the Stock Exchange

EVERY year the United States Post and Geodetic Survey publishes a book called *Tide Tables, United States and Foreign Ports,* which contains over a million figures. Each of these figures must be accurate to insure the safety of life and property, but the figures are not the results of man-made calculations. At this bureau a machine has been built which accurately predicts the tides for eighty-nine principal ports, and contains tidal information for 3,500 other places, thus giving the navigator all the necessary data for any port in the world. The machine automatically takes into account the thirty-seven components or constituents of tidal calculation. The device is about eleven feet long, two feet wide, and six feet high, and weighs approximately 2,500 pounds. To predict for a particular port the amplitudes and phases of the constituent tides, as derived from the harmonic analysis of the tide observations for that port must be modified by factors that take account of the positions of the moon and sun for the year for which the predictions are desired. These corrective values are then set on the proper cranks and dials of the machine. When the machine is set in motion, all the various components are summed up to represent the composite tide wave of nature. The machine automatically locks itself at the time of each high and low water, and indicates in addition the height of the tide. It traces a continuous curve showing the variation of the tide day by day throughout the year. The data derived from this machine is then used in the preparation of Tide Tables.

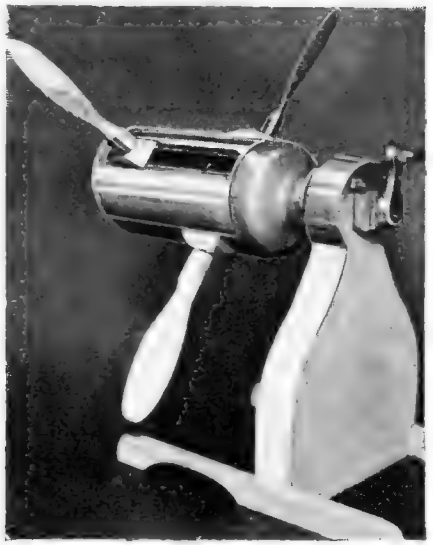


A Shoulder Line-Projecting Gun for Life Saving

A GUN with which a lifeline can be fired to a ship has been demonstrated to a delegation of French Army engineers and other French authorities, congregated on the banks of the River Seine. The device itself is the invention of Captain Erling Sohjold, of the Norwegian Army. The lifeline is in a container hung from the barrel.

A Captive Dreams of Flight

EXPERTS say that the airplane propeller which John King, a convict in the state penitentiary at Joliet, Ill., has invented, is of revolutionary design. King has never seen a modern airplane, having spent fifteen years in the prison. He says that he evolved his idea from watching the flight of pigeons. The device consists of a compound propeller



of unique construction. It has four blades, each separately connected to a hollow central shaft. Each blade is set in a worm gear. As the outer shaft revolves, the blades move back and forth in the slots provided and for the extent of the length of the shaft. The blades feather as they move toward the power-end, and then change their positions again as they make the trip in the opposite direction, so as to act against the air. It is expected that the blades will make a thousand trips a minute when the practical demonstration is given. This may be not earlier than 1938, when King is released from prison. He contemplates turning the propeller patent over to the public upon his release.

Airplane Radio—A Marvel of Compactness Possesses DX Properties

Zeh Bouck, radio operator of the Pilot Radio Plane, at the controls of the transmitter.

PHENOMENAL results in two-way radio communication have been obtained with the radio installation on the airplane Pilot Radio, which is sponsored by the Pilot Radio & Tube Corporation, and is at present making a good will flight through South America. The radio apparatus was designed by Zeh Bouck, who incidentally is the radio operator on the ship and editor of one of our sister publications. The ship is piloted by Emil Burgin, and the navigator is the well known Capt. Louis A. Yancey.

The Pilot Radio left Long Island on the 14th of May. It visited Washington, Havana, Mexico City, Colon, Talara, Lima, Valparaiso, San Diego, and Buenos Aires, at which latter city a phenomenal record of transmission was obtained. With his ship on the ground and with a temporary antenna, Operator Bouck was able to maintain constant two-way communication with the New York Times Radio Station 5,838 miles away. The transmitter on the Pilot is a fifty-watt set operating on a wave length of 32 meters. The power is derived from a twelve-volt storage battery which drives a dynamotor. The dynamotor supplies the plate and filament current for the transmitting tube. A tap on the third cell of the battery gives the six volts for the receiving set. Plate voltage for the receiving tubes is furnished by a single aircraft type 135-volt "B" battery. This apparatus is contained within a box, and when the cover of it is let down the box forms a comfortable seat. The storage battery is charged by a wind-driven generator mounted on the left side of the plane.

The power compartment. The twelve-volt storage battery drives the dynamotor which supplies plate and filament current for the transmitting tube.

Bob Hertzberg pointing to the wind-driven generator on the side of the plane.

Both in flight or on the ground, the radio equipment of this ship has demonstrated its ability to transmit messages to distant lands indicating its progress.

A Broadcast Interpreter

DELEGATES at the International World Peace Conference will not have to understand five or six different languages in order to know what the speaker is talking about. Official translators will be on hand who will immediately translate the speeches to the mother tongue of the respective delegates. The interpreter will sit directly

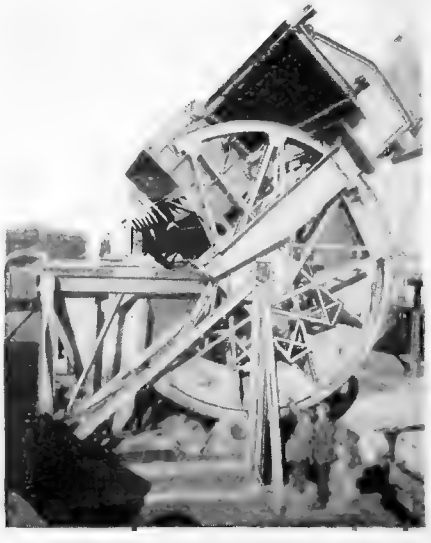
in front of the speaker's pulpit, and directly the words are spoken by the one addressing the conference the interpreter will talk into a microphone translating the speech to the delegates who will listen in with head phones. This same system is also being used on the short wave rebroadcasts from and to foreign ports.

A Five-Dollar Gold Piece Will Make 500 Square Inches of Gold Leaf

GOLD leaf is very thin. It is 1,200 times thinner than writing paper, and if you want a stack one inch high, you will need about 367,000 pieces. When gold leaf is properly beaten to a thickness of 1/150,000 part of an inch, light will show through it. An ounce of gold will make enough gold leaf to cover 175 square feet. Strange as it may seem, gold leaf is beaten in practically the same way as it was years ago by the Egyptians. So far, machinery has not been developed which will replace the gold beater's hammer blows. The uses for gold leaf are greater today than they were in the old days, but the process of beating is practically still the same.

Electricity Displaces Coal in England

AT the Avonside power station, at Warwick, England, an electrically operated coal car tipper has been installed, which is capable of completely discharging coal from a twenty-ton car in 4½ minutes. The car is run upon a special section of track and a locking bar descends to hold the car in place. Current to the electric motors is then turned on, and the track and truck are lifted high into the air and tipped completely over. When the motors are reversed, the car is brought back into position, released and towed away.



Wooden Eiffel Tower Is Aerial Mast

BERNHARD G. WARR, a young architect of Solihull, Warwickshire, England, has constructed a forty-foot model of the famous Eiffel Tower, entirely of wood. He considers an ordinary aerial mast unsightly, so to grace his garden, he built a replica of the French tower. The mast is strong enough to support his weight. Naturally there are no guy wires running across his property and the structure will easily support the aerial for his radio receiver.

Eyeglasses with Electric Lights

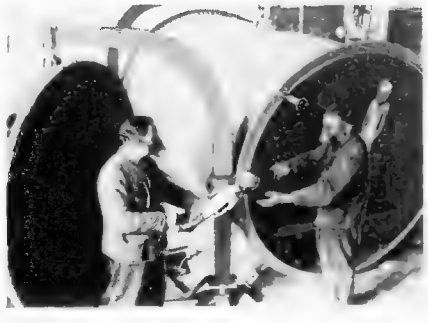
NIGHT workers will find the newest German eyeglasses a decided aid. They consist of a pair of eyeglasses fitted with circular reflectors in which are miniature electric bulbs. The bulbs are connected by a flexible cord to a flashlight battery that is carried in the coat or vest pocket. The photo shows a man reading a newspaper with the aid of the electric eyeglasses. Such glasses would also help the automotive repair man, the radio repair man, the man reading electric or gas meters or the doctor doing minor surgery.

Measuring Something in Nothing

THE photograph shows an apparatus, developed in the research laboratories of the Westinghouse Electric and Manufacturing Company, that was designed for testing the strength of incandescent filaments when they are in vacuum.

The apparatus consists of a J-shaped glass tube partly filled with mercury. The air in the remaining space in the longer part of the tube is exhausted. The filament under test is suspended in this vacuum, being clamped to the top of the tube and fastened at the lower end to a weight which floats in the mercury. By lowering the height of the mercury (accomplished by decreasing the pressure in the shorter part of the tube), the tension upon the filament can be determined under conditions similar to those of actual service. A microscope is mounted so that the elongation of the filament can be observed.

Another test made on filaments suspended in a vacuum is performed in the devices shown at the extreme left of the photograph. In these exhausted glass tubes the filaments are placed under tension by suspended weights. By allowing the wires thus suspended to remain incandescent and subject to tension until they break, lasting qualities of the filaments are ascertained.



Poison Gas for Antiques

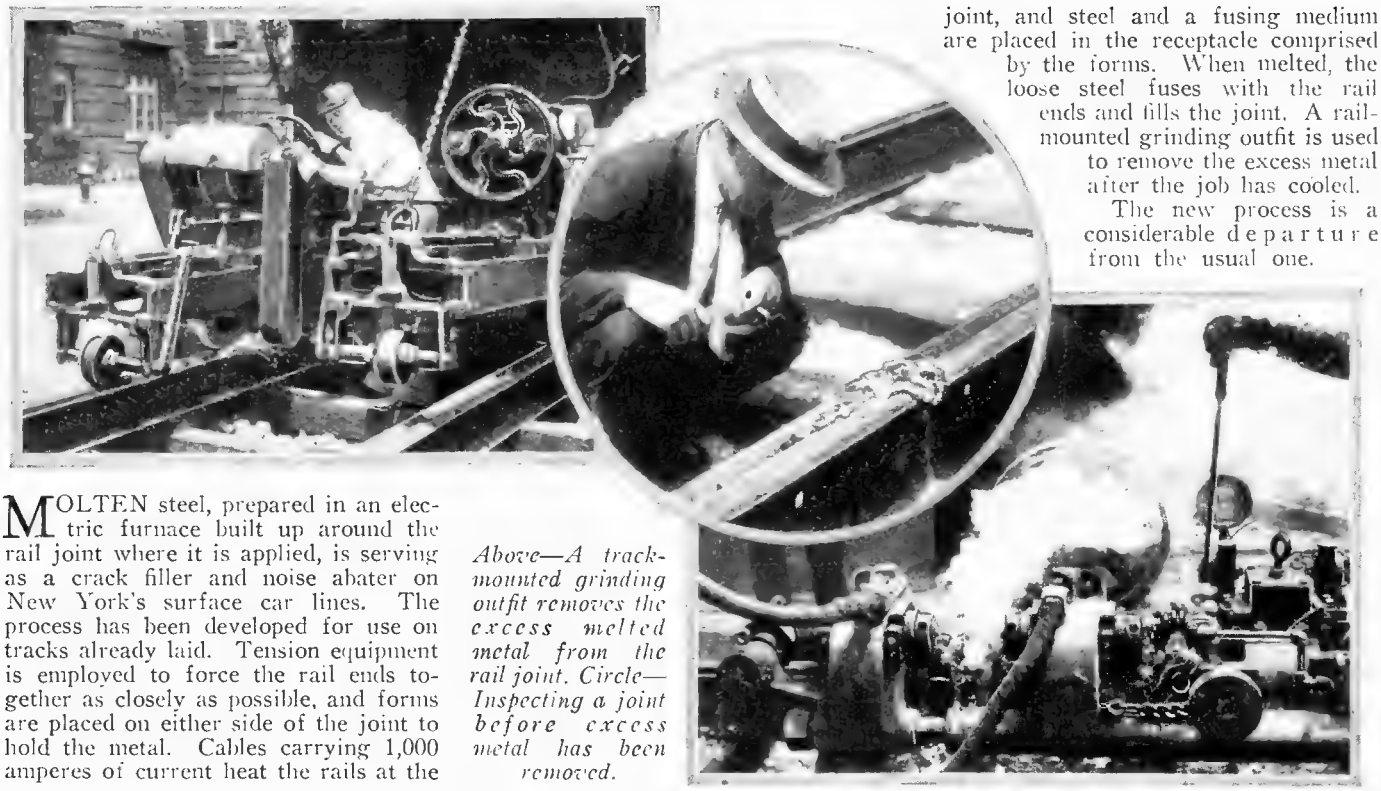
MANY of the antiques that are sent to the various museums are suspected of being ideal breeding places for germs. In handling such articles infections might be incurred which would seriously affect health, or even spread to others in the family of the person affected. In order to safeguard the health of the community in general, employes in the Asiatic Museum of Berlin, Germany, wear masks while they place the articles to be treated in a huge drum. The drum is later closed and the articles are subjected to a poison gas attack to kill all germs, before being placed on display.

Such treatment of antiques upsets the theories of fanatics, who would endow various finds with the supernatural power to spread disease. They never seem to appreciate that such objects are covered with the dirt and grime of centuries and that a small scratch might result in a serious infection.

Machine Tells How Much To Eat

IN order to maintain your youthful figure, there must be established a definite ratio between the calories of food that you eat daily and your age and height. At the International Hygiene Show in Dresden, Germany, there is a machine that calculates this ratio for you after you set the indicator for your height and age. A card is ejected that gives food values and the information that you desire. No reason, therefore, to be fat or thin.

Electrically Melted Steel Quiets Rail Joints



MOLTEN steel, prepared in an electric furnace built up around the rail joint where it is applied, is serving as a crack filler and noise abater on New York's surface car lines. The process has been developed for use on tracks already laid. Tension equipment is employed to force the rail ends together as closely as possible, and forms are placed on either side of the joint to hold the metal. Cables carrying 1,000 amperes of current heat the rails at the joint, and steel and a fusing medium are placed in the receptacle comprised by the forms. When melted, the loose steel fuses with the rail ends and fills the joint. A rail-mounted grinding outfit is used to remove the excess metal after the job has cooled.

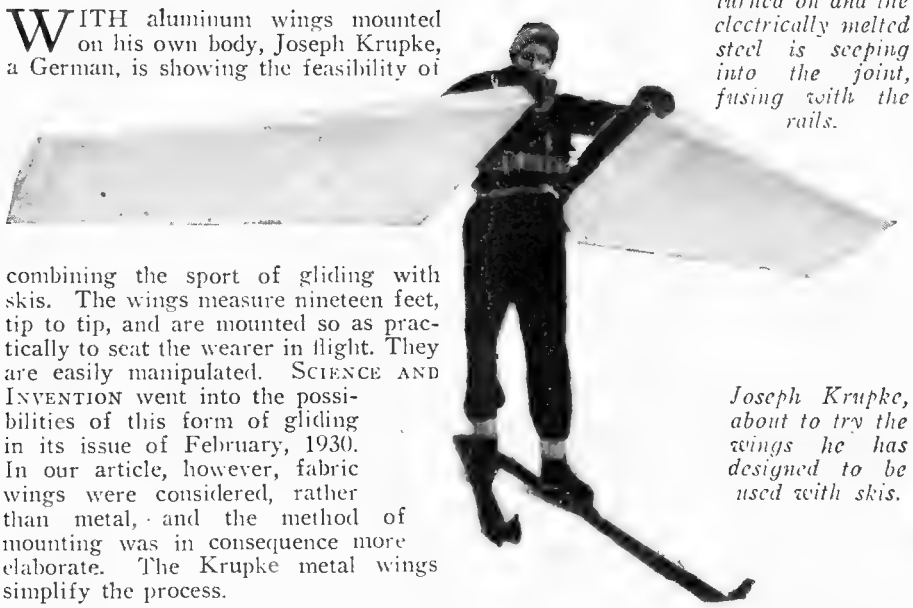
The new process is a considerable departure from the usual one.

Above—A track-mounted grinding outfit removes the excess melted metal from the rail joint. Circle—Inspecting a joint before excess metal has been removed.

The current is turned on and the electrically melted steel is seeping into the joint, fusing with the rails.

German Goes Ski-Winging

WITH aluminum wings mounted on his own body, Joseph Krupke, a German, is showing the feasibility of combining the sport of gliding with skis. The wings measure nineteen feet, tip to tip, and are mounted so as practically to seat the wearer in flight. They are easily manipulated. SCIENCE AND INVENTION went into the possibilities of this form of gliding in its issue of February, 1930. In our article, however, fabric wings were considered, rather than metal, and the method of mounting was in consequence more elaborate. The Krupke metal wings simplify the process.



Joseph Krupke, about to try the wings he has designed to be used with skis.

Angleworm Imitated

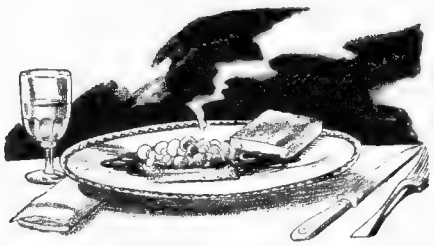
AT LAST the invention the world has been agog for all these years has been brought forth. Its birthplace is Norway, Me., and its creator is Elmer E. Aldrich. Naturally the product of Elmer's experimentation and cogitation is nothing more or less than an imitation angleworm, which is manufactured by the yard and can be cut off in any length a fish will fall for most readily. Anglers throughout These States are expected to leap at the chance of relief from the drudgery of stalking the wily earthworm. Undoubtedly there will be a notable lessening of pine-board vibrational concerts and searchlight sessions after dark.

Angleworms by the yard, invented by Elmer E. Aldrich of Norway, Me., are successfully fooling fish these days.

A Dream of Frozen Dynamos

THE phenomenon of dream warnings again reached world news columns in connection with the flight of the monoplane "Southern Cross" from Ireland to Harbor Grace, Newfoundland. J. W. Stannage, wireless operator of the plane, had a premonition of dynamo trouble on the night preceding the start of the flight. He dreamed that the flight started and went well for ten hours, after which the wireless equipment failed. In his dream he searched out the cause and found it to be a frozen (stuck) dynamo. On awaking, Stannage was impelled to make an inspection of the unit in question and found that it was actually on the point of freezing. He effected repairs immediately.

If we are to hazard an explanation, we may set the Stannage dream to the credit of sensual observations unnoticed at the time they were made, but forcing themselves on the attention of the observer when his conscious mind later was relaxed in sleep. The senses often give us data which remains unidentified but which is interpreted and acted on as a "hunch" or a dream. Involuntarily digested by the mind, the data emerges as an "inspiration" and as such is put into effect as a practical measure.



Can You Tell a Mushroom *from a* Toadstool?

By Dr. E. Bade

Relatively Few Fungi Are Poisonous, but to Avoid These Few Every Mushroom Hunter Should Know the Edible Ones at Sight . . . Only a Trained Eye Will Enable You to Distinguish the Good from the Deadly Growths

This is the edible field mushroom.

The fungus in the upper picture is doubtful, the lower one is unwholesome.

A deadly fungus—the death cup.

WHEN rains and heavy night fogs have thoroughly wet down the earth at the end of the summer season, the mushrooms and fungi appear suddenly over night. The tiny umbrellas open under the protection of brush in woodland glades or sprout up around decayed stumps. They avoid, as much as possible, direct sunlight. They prefer the twilight. Their life is short. The majority seldom attain an age of more than one day.

The food value of mushrooms is great although they are not easily digested—a peculiarity due not only to the quantity of foodstuffs they contain, but also to the cellulose membrane with which they are covered. They are not adapted for persons with weak digestive systems and if eaten to excess may cause even a person with a strong stomach to become ill. But this is due entirely to the quantity eaten and not to any fungi poison.

An entirely different set of facts must be considered where the mushrooms eaten are not quite fresh. Mushrooms spoil rapidly, and the products of their decomposition resemble ptomaines in their action. The decay of a fungus cannot be detected by odor or appearance. It is said that edible mushrooms, when picked and kept for too long a time even under ideal conditions, produce irritations in the digestive tract, though without endangering life.

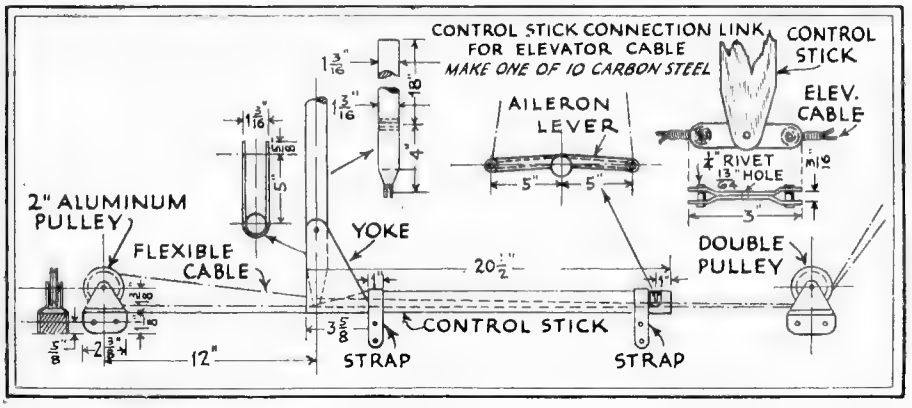
Other factors must be considered where really poisonous fungi are eaten. Many of these do not contain any one specific poison, but a variety of them. In the fly *Amanita*, for instance (*Amanita muscaria*), whose reddish yellow hat is decorated with white warts, is found the poison amanitine and muscarine. The latter stops the action of the heart immediately but another poison, atropine, nullifies the first poison on injection. This does not remove the poisons. The active poison is not so much the muscarine as the amanitine. At the same time the fly *Amanita* does not seem to have a uniform poison strength, for the people of

(*Continued on page* 458)

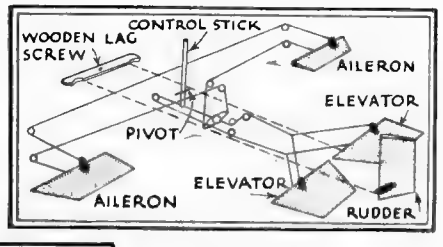
Field mushroom—Agaricus sylvaticus—Peppery lactarius—Clitocybe laccata—Glistening coprinus—all edible.

These three fungi are all edible but uncommon forms.

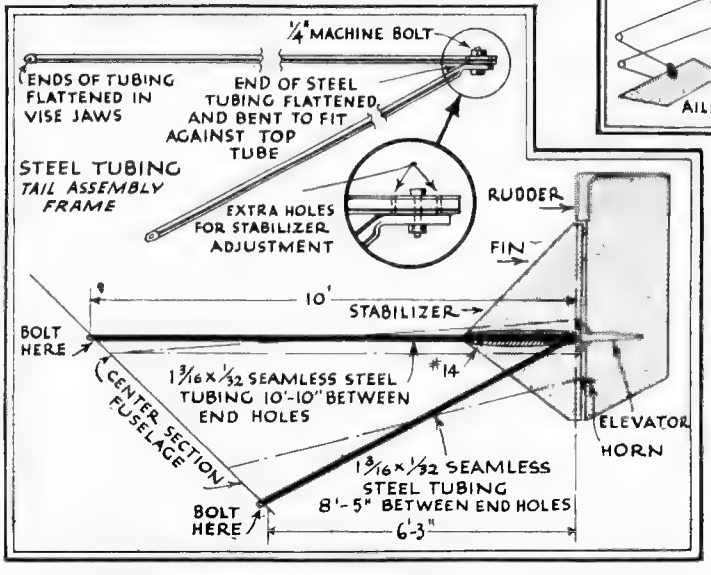
How to Build a SCOUT



Above is shown the control stick assembly for the SCOUT Secondary Glider. Below appear the tail control surfaces and the steel tube framework which supports them.



Above—Complete plan of the SCOUT control system, with wires leading to aileron horns and tail surface controls.


¼" MACHINE BOLT
ENDS OF TUBING FLATTENED IN VISE JAWS
END OF STEEL TUBING FLATTENED AND BENT TO FIT AGAINST TOP TUBE
STEEL TUBING TAIL ASSEMBLY FRAME
EXTRA HOLES FOR STABILIZER ADJUSTMENT
RUDDER
FIN
10'
STABILIZER
BOLT HERE
1 3/16 x 1/32 SEAMLESS STEEL TUBING 10'-10" BETWEEN END HOLES
#14
CENTER SECTION FUSELAGE
ELEVATOR HORN
1 3/16 x 1/32 SEAMLESS STEEL TUBING 8'-5" BETWEEN END HOLES
BOLT HERE
6'-3"

By Lieut. H. A. Reynolds

This Is the Third of a Two the Wings, Center Covered. The Present and Details of

THE control stick assembly should be built at this time. A seamless steel tube 20½" long by 1 3/16" diameter is sawed off at a taper extending for 3⅝" at one end. A control stick yoke is cut from No. 10 carbon steel and welded to the tapered end. The control stick is next made from a seamless steel tube 22" long by 1 3/16" diameter. A pivot hole is drilled in this tube 4" from one end, and this end is slotted and hammered to a taper. It may be drilled to receive a bolt and a connection link (see drawing); or better, the fork end of an aircraft fork turnbuckle is welded to the tapered end and the control cable later on linked to this fork by a small bolt with cotterpin.

Steel tubing of aircraft grade 1 3/16" with walls approximately 3/64" thick can be procured from any large aircraft supply house. We would suggest the Johnson Airplane & Supply Company, Dayton, Ohio.

The control tube is pivoted so that it will move forward and backward in the yoke. The whole assembly will rotate sideways, being held to the runner section by two steel straps 1" wide which serve as sleeves for this motion. Two small halfmoon-shaped spruce blocks are glued underneath the control tube between these two straps to give the tube a better support with minimum friction.

To make the aileron lever, a piece of steel tube 10" long by ¾" diameter is welded into a groove sawed in the control tube 1" from its rear end. Two pulley brackets are cut from 1/16" thick carbon steel. The first one is bent to fit one 2" pulley and the second to fit two. Bolts with nuts hold the pulleys in place, allowing them to rotate freely but without wabbling. Lock the boltnuts with a centerpunch. The single-pulley bracket is bolted to the runnertop 12" in front of the control stick. The double pulley bracket is bolted to the runner just behind the main upright (see side view drawing of center section). To lead the elevator control cables from the control stick through the control tube and backward over the double pulley, a ¼" hole must be drilled horizontal through the main upright, the diagonal and also the fillet blocks. Be careful to drill exactly through the center of the main upright ⅜" above the runner, in order not to weaken this important upright member more than necessary.

We next prepare the seamless steel tube framework which is to support the control surfaces of the tail. We use 1 3/16" diameter steel tubing for this purpose. The two top tubes measure 10' 10" between the end holes and run back fork-fashioned from the center section fuselage. The end holes are drilled ¼" at right angles to each other. One hole admits a ¼" steel bolt up and down through it and the No. 13 stabilizer fitting together with the flattened end of the bottom frame work tube, while the other hole admits a ¼" steel bolt sideways to attach it to the fuselage. The bottom framework tubes are shorter, measuring 8' 5" between end holes. One end of these tubes is flattened for about 4" and bent so as to fit snugly against the top tube when in position. Three ¼" holes ¾" apart can be drilled in the top tube at this end and the bolt shifted into one of them to raise or lower the whole tail assembly for better flying adjustment. The ends of all the tubes, except the rear ends of the top tubes, are hammered flat and the edges welded before the end holes are drilled. The position for the hole on the top tube which admits the bolt securing the No. 14 front stabilizer fitting is carefully marked and drilled last, when its exact position can best be determined.

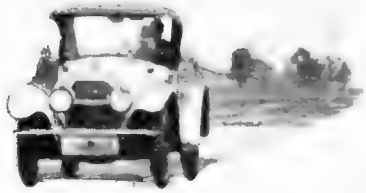
Fasten the wing frames to the center section. Now bolt the tail section in place using ¼" steel bolts. Lock the nuts. The tips of the wing frames may rest on the floor and the tail assembly can be supported on saw horses or wooden props. The glider is now ready to receive the steel wire rigging.

We are showing a side, front and top view of the glider with each rigging wire carefully plotted in its position. It is well to use fork turnbuckles on all these wires,

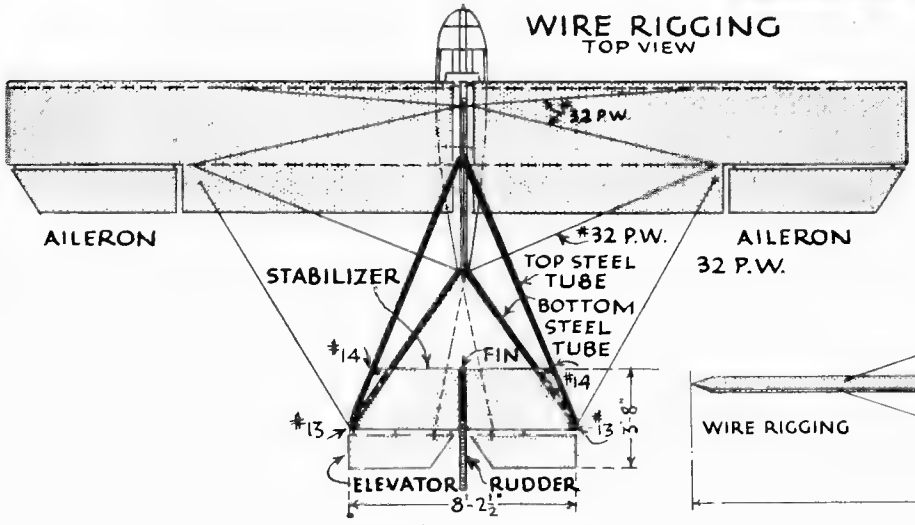
Secondary Glider

and Herr Martin H. Schempp

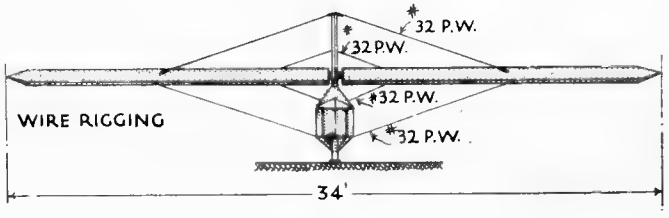
Construction Series. . . . In the First Section and Control Surfaces Were Article Considers the Control System the Framework



A popular development in gliding machines is the ship mounted on wheels and intended for continuous towed flight behind a motor car. This type is particularly good for flat country.



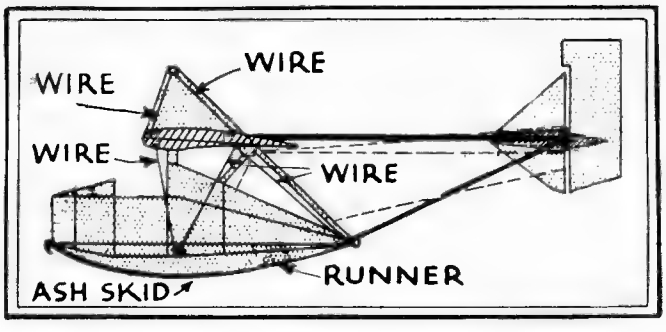
Below and at the left are drawings showing the control system of the SCOUT from three angles, with gauge of piano wire controls indicated. The steel tubing used behind the center section makes the SCOUT far superior in strength to the great majority of motorless planes.



fastening the fork ends directly to the metal fittings on the framework, using pins secured with cotter pins. The Heath Airplane Co., 1721 Sedgwick St., Chicago, Ill., sells a No. 326 fork turnbuckle which is very satisfactory for glider rigging. Hard wire coil ferrules for making the wire connections can be purchased from the same source. Use a good grade of steel wire—No. 32 or No. 34 piano wire can be secured at your local hardware store, or No. 12 plated aviator steel wire can be purchased from the Heath Company for 60 cents a pound. Fasten and adjust the landing wires—on top of the wing, first. Pull the wings up so that the wing tips are about two inches higher than the butt ends at the fuselage. This is to give the wings a slight dihedral which will make the glider more stable in flight. Now the flying wires, which are running down to the runner and will hold the wings in flying, are cut, fastened and adjusted with the turnbuckles. Cut the steel wire with a cold chisel. The wires should not be too tight or they will cause unnecessary strain in the framework. Be careful not to twist the wings. The angle of incidence given at the wing root by the wing brackets must remain the same to the wing tips.

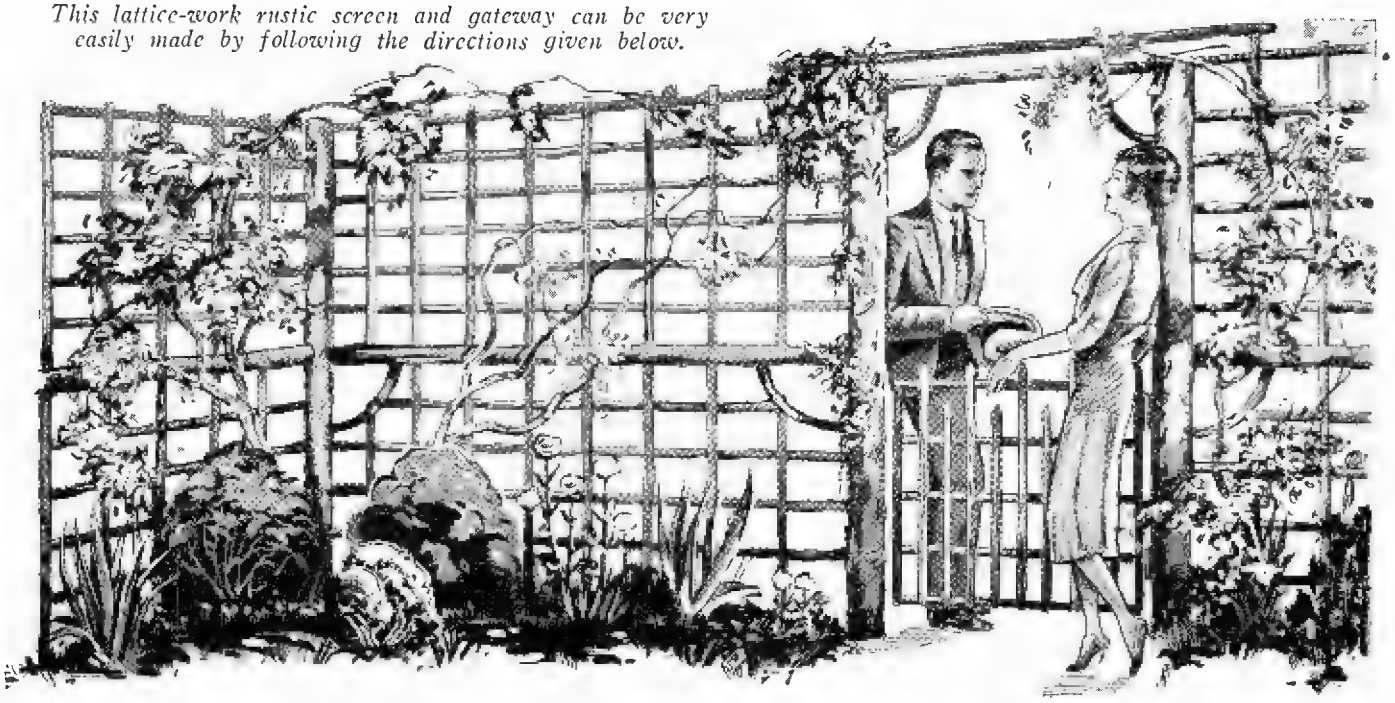
The control wires are of flexible steel cable which will bend easily when rolling over the aluminum pulleys. The Heath Company sells a 3/32″ flexible aircraft cord for $4.50 per 100 feet. Study the drawing of the control wires and install the wires which move the ailerons. The aileron control cable running through both wings is cut between the wings and an eyelet turnbuckle set between — an arrangement which will save time in assembling and disassembling the glider. When the stick is moved to the left the left aileron, seen from the pilot's seat, should move up. Next connect the control wires to the elevators. When the stick is pushed forward the elevators should flap down.

A control cable is run from each rudder horn end to the ends of the foot rudder bar. Pushing the rudder bar on one side should move the rudder to the same side.



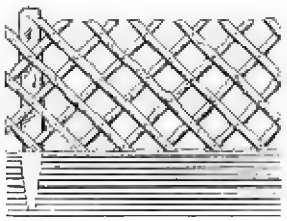
Pieces	*Name*	*Material*	*Size*	*Length*	*Notes*
1	control tube	seamless steel tube	1 3/16″ ϕ	20½″	aircraft grade, .065″ thick wall
1	control stick	seamless steel tube	1 3/16″ ϕ	22″	aircraft grade, .065″ thick wall
1	control yoke	carbon steel	3⅝″ x 13″		1/16″ thick
2	control tube straps	carbon steel	1″ x 8″		1/16″ thick
2	control support blocks	spruce			fit between straps
1	aileron lever	steel tube	¾″ ϕ	10″	
1	pulley bracket	carbon steel	2⅜″ x 3⅝″		bend to fit pulley
1	double pulley bracket	carbon steel	2⅜″ x 3⅛″		bend to fit pulley
3	pulleys	aluminum	2″ ϕ		with groove
1	tail support frame	seamless steel tubes	1 3/16″ ϕ	39″	aircraft grade, .065″ thick wall
5 lbs.	bracing wire	piano steel wire			No. 32
50	wire coil ferrules	hard iron wire			
24	fork turnbuckles	copper			aircraft grade
3	eyelet turnbuckles	copper			aircraft grade
150′	control cable	steel cable	3/32″ ϕ		aircraft grade, flexible
	bolts and pins	steel	¼″ and ⅛″		

This lattice-work rustic screen and gateway can be very easily made by following the directions given below.



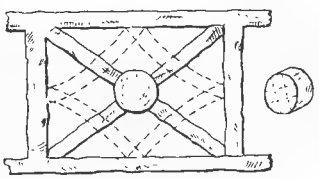
Beautify Your Garden *with a* Rustic Fence

By J. E. Lovett*



LOW RUSTIC FENCE

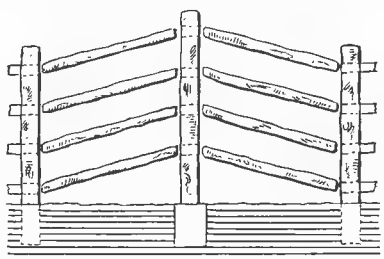
Sturdy Boughs and an Axe Are the Only Requisites for Making Rustic Fences, Gateways, and Seats. Train Rambling Roses or Creepers to Cover Them, and Your Grounds Will Be Enormously Improved



NEAT RUSTIC FENCE

WHY not put a rustic fence around your garden? Covered with ivy or rambling roses, it adds to your property's beauty, and, in addition, provides you with privacy. You may construct one, too, to conceal some ugly feature of the wall, or a garage that tends to destroy the effect of the rest of the garden. It can be erected to hide water butts, placed in the corner to catch rain from neighboring roofs. And seats may be built to match, either for the whole length, or part. If a tree grows close to the fence, it is comparatively easy to put a seat around it.

The diversity of styles in this branch of fencing immediately confronts anyone who is interested in rustic woodwork. Chief among those are the exotic, crazy type, or the slightly rough. The latter style preserves the balance of a more formal fence of trimmed wood, and is in keeping with the spirit of the average garden. Neither style need be the unstable, roughly wrought object usually associated with rustic work. The proper construction entails a minimum of nails and a maximum of ingenuity. Where oak is used, nails make for instability, for the acid in the wood quickly corrodes iron. So, for the sake of strength and appearance, the joints used will be the mortise and tenon, the bridle and the half-lap, the latter being preferably bored and pegged.



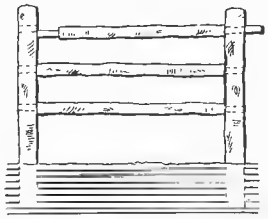
METHOD OF RENEWING A POST

As for the wood, pieces with smooth bark and regularly curved lines will be best. If, however, the fence is to be grotesque in form, the smaller branches of the oak are useful. These branches are crooked grained, hard and knotted. They cannot be split and are useful for fences, trellis-work and arches which are to be covered or partly covered with creepers or roses. With these, as also with other hard rough-surfaced sticks, rustic chairs can be made. Besides the oak, rods cut into lengths of from four to six inches in diameter are required. These are nailed together as shown, and thus a chain is made. Oak is the best wood for the purpose, except that (as mentioned before) it corrodes iron nails. If durability is most

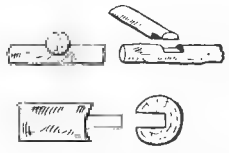
(*Continued on page* 463)

POST HOLES
CORRECT INCORRECT

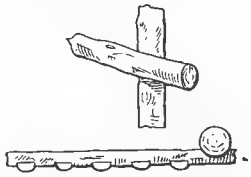
A RUSTIC CHAIN



RENEWING A RAIL



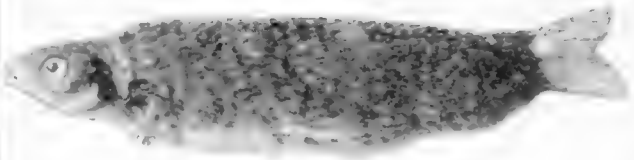
JOINTS USED IN RUSTIC WOODWORK



ABOVE-WEAK METHOD OF JOINTING
BELOW-PLAN OF FENCE

* Winner of Third Prize in Handicraft Contest

Would You Believe It?



Fur-Bearing Trout?

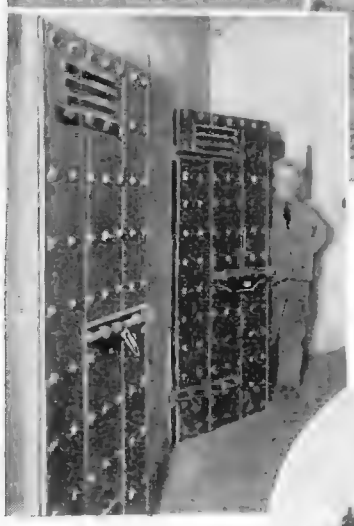
RECENT newspaper reports would have it that this relative of the trout family will be raised commercially for its fur. It was supposedly discovered in Iceberg Lake by J. H. Hickens, of Whitefish, Mont. The fish is a hoax. The fur was sewed on by a joker.

A Brook Down the Center of a Business Street

TENNYSON'S "Babbling Brook" never ran down a business street, but here is a brook which runs merrily along Cheap Street, Frome, Somerset, England. Shopkeepers find it useful for washing fish, as this photo shows, or cleaning windows and store fronts.

Liberty's Prison

THE last place in the world one would look for a prison is in the Statue of Liberty. Nevertheless, there is one in the pedestal that supports the Goddess. It was once utilized as a place of detention for minor violations of military discipline.



Ewing Galloway

Fourteen Trees Growing from Log

THERE is very little contact with the earth here. The fourteen young trees get their sustenance from the mother log of a fallen Redwood near Crescent City, Calif.

Tortures of Religious Fanatics

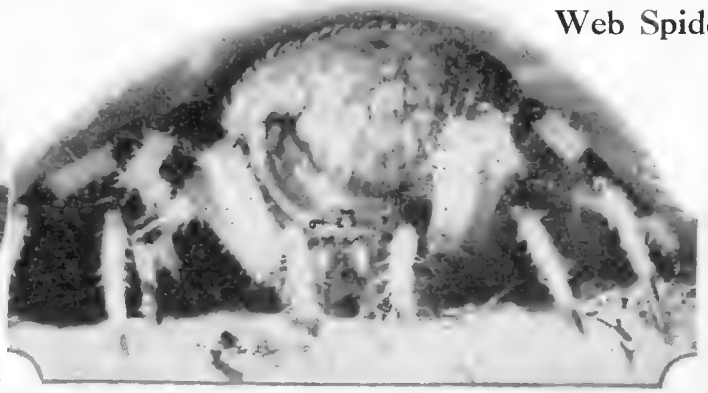
RELIGION will make men go even to the ends illustrated in this photo. After an hour and a half of ceremonies, this Hindu has more than 600 hooks and pins inserted in his body. Limes and flowers are suspended from the hooks and his body is sprinkled with holy water from the dirty Ganges.

Devil's Tower

Ewing Galloway

MILLIONS of years ago, a basaltic mountain mesa was created by a natural upheaval in the Black Hills of Wyoming.

Web Spider



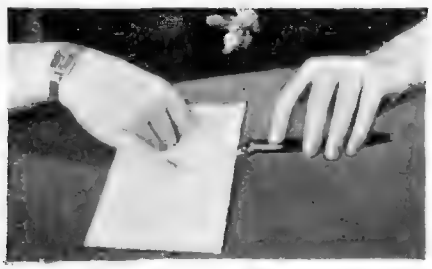
HERE is a remarkable close-up of a web-spinning spider, which shows to advantage the cactus-like legs and the numerous beady eyes.

Scientific Aids to Your Comfort

By Mary Jacobs

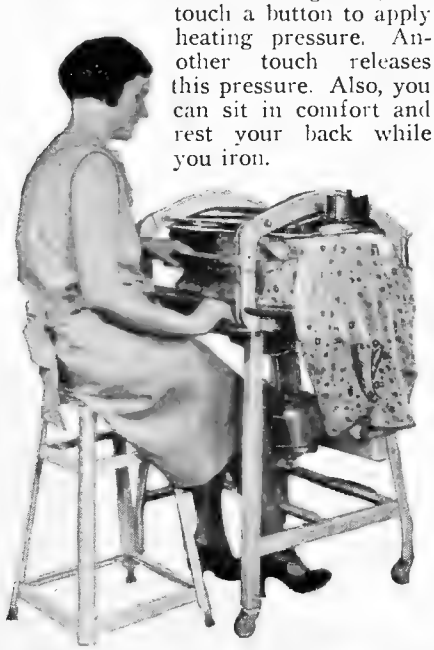
Try This Pencil-Letter Opener Combination

PICK the pencil up, and you will see an improved clip pencil. The lead is adjustable, as with the regular filler, there is an eraser under the top cover, and underneath it, the compartment for spare leads. But just release the silver clip with the pressure of your thumb—you have a very neat and efficient letter opener. The clip is equipped with a snap grip to maintain its tension permanently. The pencil is standard pocket size.



Sit While You Iron

HOW would you like to iron a surface of 270 square inches in one operation? And have your shirts, dresses, dainty lingerie, and other difficult pieces pressed without a crease? According to the manufacturer of the latest electric iron on the market, these accomplishments require no special skill. All one need do is place the garment on the press, lower the balanced heating shoe, and touch a button to apply heating pressure. Another touch releases this pressure. Also, you can sit in comfort and rest your back while you iron.



Fresh Air at Your Desire

WHEN it's hot in the dining room or any other part of the house, it's nice to have a window-type fan to induce a current of cool air. When the smell of cooking foods aggravates you, and the air is close, the fan affords quick relief. A reversible motor enables this unit to exhaust stale or tainted air and bring in fresh air. A mere pull of the switch cord will change the direction of its rotation. The fan is equipped with an adjustable frame to fit any window, and the manufacturer claims that since the motor is suspended on springs, the noise and vibration are minimized.

Heating Inaccessible Places

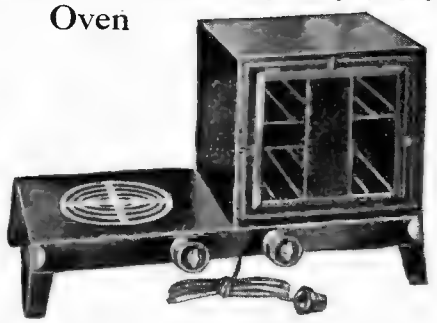
IF it's difficult to heat your bathroom, sun parlor, or kitchen, if you want to keep warm on chill fall nights, install this electric wall heater. According to the manufacturers, it provides heat from both radiation and convection, and comes in either a 1,300 or 2,000-watt capacity, controlled by a three-heat switch.

Package Container

YOU won't have to fear that your groceries will be stolen from outside the door—not if you install this all-steel package container in your outside wall. It locks automatically from the outside, and releases when the inside door is opened. The outer door is insulated, and the inner one ventilated by four louvers, so as to protect the contents from freezing or over-heating.

Particularly helpful for eliminating cooking odors.

Electric Stove with Portable Oven



THIS stove has been made for heavy duty, say the manufacturers. It is a 1,000 watt affair, comes with a reciprocating four-station switch—high, low, medium, and off, and is finished in triple black enamel. The portable oven is equipped with a double heat-spreader and two adjustable grills.

Molds for Ice Box Cookies

CHILLING cookie dough makes it more tender, so now we have ice box molds of sheet metal, whose capacity is from 50 to 75 cookies. You merely open them along the entire side, fill with dough, and fasten with three metal clips. The sheet metal is described as being folded along the edge to eliminate sharp edges. The molds come in heart, diamond, spade and club shapes.

Names and Addresses of Manufacturers Furnished on Request

Prize Puzzles *to* Polish Your Wits

How many empty squares can there be without having three in line?

By Sam Loyd

THE Puzzle King presents the ninth of a series of problems, the solving of which will show if your mathematical ability is bolstered up by logical reasoning. Prize winners of the June puzzles and solutions will be found on page 445.

Twenty-five Dollars in Prizes

A FIRST PRIZE of $10 will be awarded to the person sending correct answers to the two puzzles *accompanied by the best expressed analysis of the Senatorial Discretion Problem.*

A SECOND PRIZE of $5 will be awarded for the next best analysis and correct answers to the two puzzles.

TEN PRIZES of $1 each will be awarded to the ten persons who send the next best analyses of the Senatorial Discretion Problem, together with correct answers to the two puzzles.

Answers must be received not later than noon, Sept. 15, addressed to "Puzzle Editor," SCIENCE AND INVENTION, 381 Fourth Avenue, New York City.

All contestants must abide by the decisions of Sam Loyd, who will examine all papers and award the prizes.

Papers of identical merit, tying for any one of the prizes, will each receive the full amount of the prize tied for.

Ann Hathaway's Problem

IN Ann Hathaway's cottage, still standing near Stratford, is a window of thirty-six panes, as shown in the picture, and puzzle history tells how on one occasion the English maid, who had been escorted home, confused the mighty intellect of the Bard of Avon, with the following problem:

"You will notice," said she, "that my little brothers have eliminated four of the square panes, but that they have carefully avoided removing more than two in any one row. Now, I see a neat problem involved in their game, and I want you to tell me how many more panes they can demolish without violating that rule that there must not be more than two removed from any one row—horizontal, vertical or diagonal—and that no three empty squares are to be in straight line from any point of the window's square border line."

Shakespeare had to rush home to dash off a sonnet, and it is not recorded that he ever answered Ann's puzzle. Let us see who can work it out at this late day. How many more panes can be removed according to Ann's conditions, and which panes are they? Fill in the panes that you would suggest removing.

Senatorial Discretion

WHEN Senator S. lined up with the Drys, he considered it discreet to keep his own cellar above suspicion.

So he let it be known that his noted stock of beverages had been diluted to a lawful percentage of the taboo spirits.

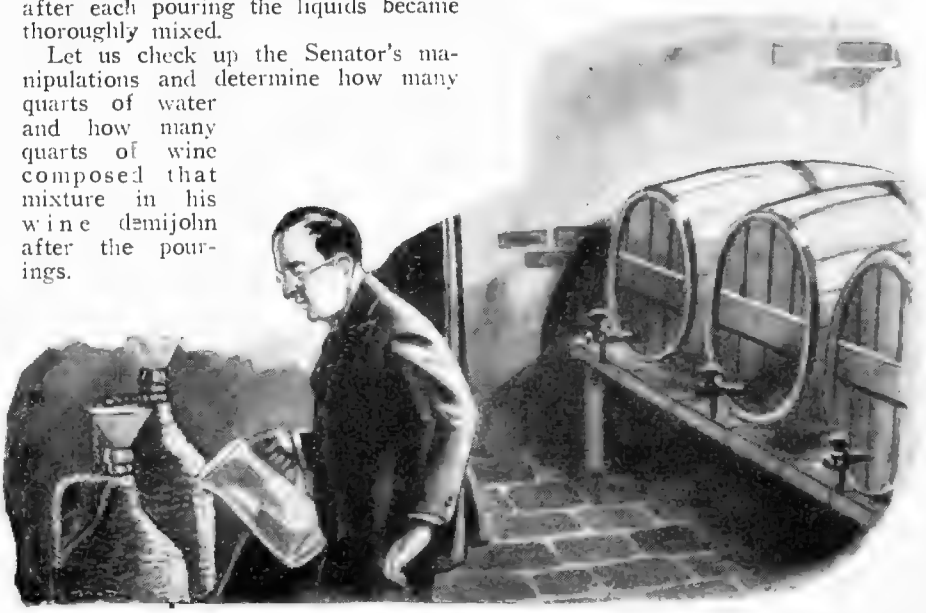
Our puzzle deals with a demijohn of fine old port, which they say the famous legislator wept over as he cut it down.

As indicated in our sketch, one of those demijohns at the start contained pure wine and the other pure water. Now let us review the Senator's operations, as he later described them.

He first poured from the water demijohn into the wine demijohn enough water to double its contents. Then he poured back from the wine demijohn into the water demijohn enough of the mixture to double its contents. Then, to equalize matters, he again poured from the water demijohn into the wine demijohn enough to double the contents of the wine demijohn, and this final operation left in each demijohn the same number of quarts of liquid, although in the wine demijohn there was then three quarts more of water than of wine. Of course, it is assumed that after each pouring the liquids became thoroughly mixed.

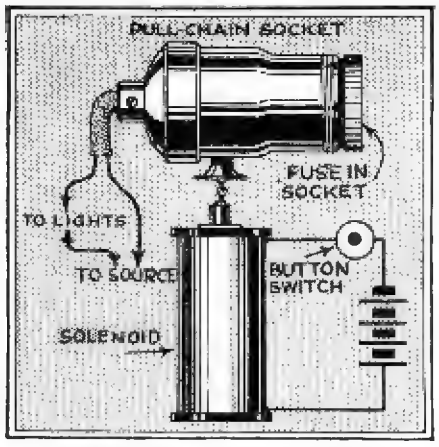
Let us check up the Senator's manipulations and determine how many quarts of water and how many quarts of wine composed that mixture in his wine demijohn after the pourings.

Senator S. propounds a practical prohibition problem.



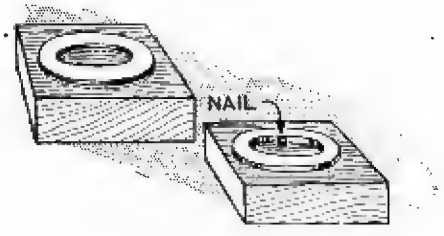
WRINKLES

$5.00 First Prize
A One-Button Remote Control



THE main feature of the illustrated switch is that it needs only one button to control it. A fuse-plug is screwed into a pull-chain socket so it can be used as a switch. An iron rod about 1½′ long is attached to the chain and used as the plunger of the solenoid. When the current is turned on the solenoid pulls on the chain, thus turning the switch. Turning the current on again repeats this action, doing away with having an extra button.—*G. E. Taylor.*

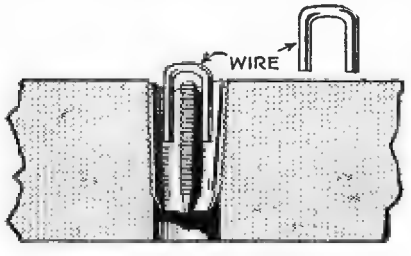
Easy Method of Filing Flat Washers



SOMETIMES flat washers are too thick for use and to file them in a vise would be too difficult. By driving the washer into a soft piece of wood it may be easily filed; simply lay the washer on a flat piece of wood and drive half way down with a hammer. Or another way, drive a nail into a bench or wood, so head of nail is just below surface of washer. Lay washer over nail, file forward only, a little to one side of center, and washer will turn slowly and an even cut will be made.—*J. A.*

Removing Broken Tap

IF tap is tight fill hole with nitric acid and allow it to stand for a while, remove acid and flush hole with water.



Then take a stiff heavy piece of wire and bend it in a U-shape, as shown, and insert this in the flutes of the tap.

Turn with a monkey wrench and the job is complete.—*Joseph D. Amorose.*

For a Can of Paint

PAINT and enamel are put up in crimp-top cans, and when the lid is removed, a deep channel is opened. When using the contents of the can, this groove becomes filled with paint. Use a nail to punch six or eight holes in the groove; the paint can then flow back into the can.—*Mrs. Eugene Chrisman.*

Correcting Blueprints

MIX baking soda to the consistency of thick ink. Dip an ordinary pen into this ink, make any inscription needed, let dry. The lines of printing added will turn the blue surface a clear white. A small print may be made by drawing any figures on an old print with this ink, thereby saving tracing or printing.—*Dallas Cooper.*

Clean Mechanic's Hands

TO protect and rid the hands quickly of stubborn dirt apply to the hands about one tablespoonful of automobile lubricating oil. Rub the hands vigorously until they are warm. Then wipe them thoroughly with a clean soft cloth. Lastly wash them with soap and water. —*Frank A. Hall.*

CONTEST AWARDS

Winners in SCIENCE AND INVENTION's Workshop and Handicraft Contests are announced on page 467 of this issue.

Preservative for Manila Rope

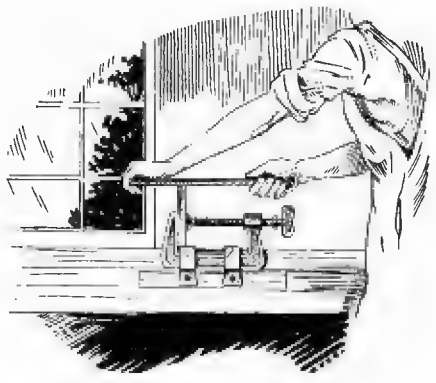
MANILA ropes are made of long tough vegetable fibers, the fibers first being twisted into yarns, and the yarns into strands, and the strands are then twisted into ropes of varying diameters and tensile strengths. A cable is made by twisting ropes together.

A very good preservative and dressing for manila ropes is made by mixing together the following, in the proportions shown:

Rosin oil	1 gallon
Pine tar	½ gallon
Oil of myrbane.....	5 ounces
Mineral oil .....3½ gallons	

The preferred mineral oil is one made from an asphaltic base crude oil having a viscosity of about 60 seconds at 210° F., and one with a pour test of about 30° F. This is an oil similar to that used by railroad and electric railway companies for saturating waste used in journal boxes for bearing lubrication. —*Dwight Lloyd.*

An Emergency Vise



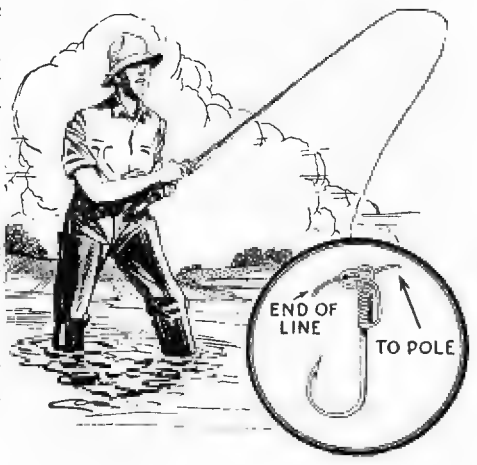
A GOOD, strong vise for holding small blocks of wood or small articles can be made by fastening a fairly large clamp to the edge of your work bench.—*W. F. Porter.*

To Paint Stairs

IN refinishing the woodwork of the home recently it became imperative to paint some stair treads. The stairs were necessarily in use quite a number of times a day. Painting one side, allowing it to dry, and then finishing the other would not do, as this would leave a mark in the tread. The problem was solved by painting alternate treads and using the other unpainted ones until the first treads became dry.—*H. H. Van Keuren.*

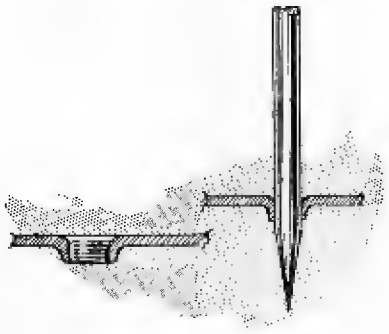
Tying on Hooks

A GOOD method of tying fishing hooks to a line so that they may be taken on or off very quickly is to first run the line through the eye of the hook, then wrap the line around the shank ten or twelve times. Bring the end of the line up to the eye and through a loop that is made by pushing the main part of the line back through the eye. Pull very tight and after the line is wet it will make a very good knot.—*Wilbur H. Rose.*



and RECIPES

How to Tap Thin Metal



VERY often it becomes necessary to set a machine screw in sheet metal which is too thin to give sufficient strength in the thread. To overcome such a difficulty the hole should be drawn out with a punch as illustrated, instead of drilling it.

This way the metal is formed into a sort of cylinder and may be readily tapped. Also, the shank of the punch should be of the same diameter as the standard tap drill.—*J. D. A.*

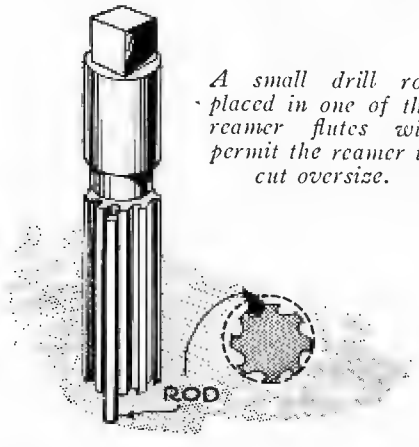
Paint or Grease Spots

IF you get pitch, tar, paint or grease on your clothing, before wetting or soaking try rubbing fresh lard on it with the hands. When the spots loosen, wash them out with good soapy water. —*Ethel Devore.*

To Make Straight Reamer Cut Oversize

A REAMER can be made to cut oversize by placing a heavy wire or drill rod in one of the flutes of the reamer as shown; this wire should be of such thickness so as to insure its extending a trifle beyond the cutting edges. Since such reamers are made with flutes of varying depths, the wire may be moved from one flute to the other to increase the depth of the cut.

When a reamer has become worn and its diameter is consequently reduced it can be made to cut a hole its original size, whereby if the reamer were sharpened by grinding the tool's diameter would be further reduced.—*J. Damon.*



A small drill rod placed in one of the reamer flutes will permit the reamer to cut oversize.

Tagging Equipment

IF tags are placed on tool boxes, batteries, motors, etc., showing the date last oiled, sharpened, charged, or gone over, much negligence can be prevented. This prevents undue wear on bearings, rusting, etc., from using tools and motors that you thought had been looked after and had not.—*Burl Knutson.*

Keep Your Shirt from Bulging

TO prevent one's stiff tuxedo or dress shirt-front from bulging, call into use an ordinary rubber band. Fasten the elastic about the top trouser button, the lowest shirt button, and the lowest vest button. Then fasten the clothes as usual. This attaches the shirt securely to the vest and trousers, prevents the shirt from protruding, and adds greatly to the comfort of the wearer.—*Mary L. Toevs.*

Rust and Stain Remover

COMMERCIAL acetone, obtainable at any drug store, affords a very good agent for removing rust and stain from metal surfaces. It is especially good for keeping the ways of a lathe clean and free from stain and rust. Apply with a rag or ball of waste saturated in the acetone. Before it becomes thoroughly dry by evaporation rub dry with clean waste or a clean dry cloth.—*E. F. Shawver.*

$5.00

will be paid each month for the best wrinkle or recipe submitted to the editors and which they accept and publish in these columns. All other ideas accepted and published in this department will be paid for at regular rates. Address your ideas to—*Editor Wrinkles and Recipes.*

To Keep Several Paint Brushes in One Container

WRAP each paint brush in a paper, separately. Put them all in a bucket half filled with water. The paint will not mix. When ready to use, take the paper off and shake out.—*A. E. Carroll.*

A Substitute for Moth Balls

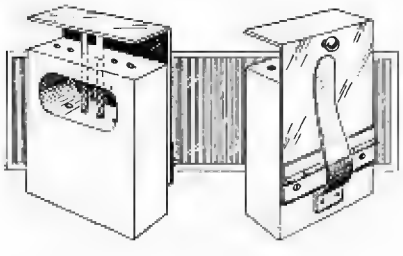
NO one likes the odor of moth balls. If a small quantity of bitter apple powder is obtained from the druggist and sewed up in little silk bags, one or two of these placed among the clothes will prevent moths from entering.—*Mrs. Dick Richard.*

Easily Made Tent

A SQUARE of heavy material hung by one corner from any convenient support will make a comfortable shelter; it will shed rain and reflect heat. A 7×7 foot sheet is enough for a one-man shelter; a 9×9 will house two.—*Harry Jonakin.*

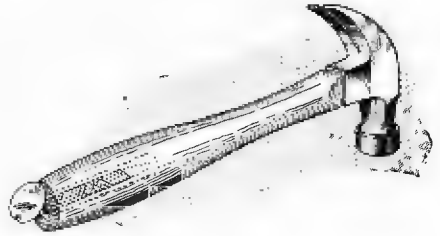
Drill Holder

THIS is an excellent drill holder which can be adapted to practically any form of drill, the size of the box being constructed to meet the requirements. It is particularly suited for small drills which have a strange habit of becoming lost when they are most needed. A block of wood is drilled out at the extreme ends of an elliptical figure drawn upon the block. Then the center portion is chiseled out, and the opening thus formed is filed smooth.



Longitudinal holes slightly larger than the drill to be accommodated are then drilled through the block just deep enough so that the drills project to practically the same level. There is no trick to this—merely insert the drill deeply in the drill holder and drill as far as possible. Now provide a metal cover exactly as shown in the illustration, solder to a hinge, which is then fastened to the back of the block. A suitable spring holds this metal cover in place.—*W. James Nichols.*

Keep the Drift Handy



BY simply boring a small hole in the end of the hammer handle and making a small spring plate to the shape of the handle end with a notch and depression to fit, the carpenter's drift or the machinist's prick punch can always be kept handy.—*C. H. Willey.*

What's New in Radio

Mantelpiece Receiver

A NEW type of radio receiver, and one which aroused much interest when displayed at the recent Radio Manufacturers' Trade Show has been announced by the Keller-Fuller Manufacturing Company.

This receiver, called the "Radiette," has been likened to a mantelpiece clock because of its similarity to that item, and has further novel and distinguishing features. It is all-electric in operation, requiring only the plugging in of the supply cord to a convenient wall receptacle; it is single control in tuning; has one control for volume; and it has a built-in electromagnetic speaker. The overall dimensions of this novel receiver are 16 inches high, 7 inches deep and 14 inches wide. The cabinet, of fine finish, houses the tuned r.f. receiver, loud speaker and complete power supply, for both filament and plate circuits.

A knurled drum dial permits smooth easy rotation of the tuning condensers.

Loud Speakers, Reproducer Units and Microphones for Speech Amplifiers

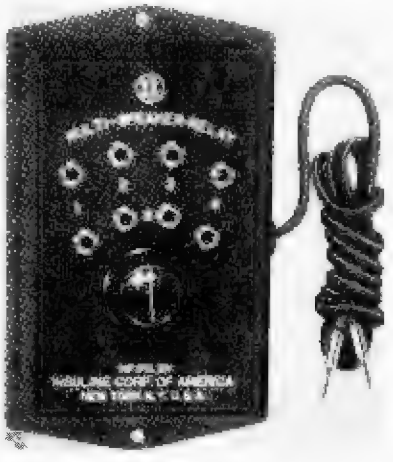
COINCIDENT with the tremendous popularity of speech amplifier installations for use in public address work, in the reproduction of music or speech at public gatherings, in parks, or for the entertainment of patrons in restaurants, dance halls, etc., equipment which may be classified in the category with the accessories of speech amplifiers has also experienced a great demand.

The Miles Reproducer Company is now manufacturing a dynamic air-column unit used principally for theater and outdoor work. This company also produces a line of 3½, 5, 6 and 9-foot exponential horns. In addition, it manufactures single and double carbon button microphones together with suitable stands for public address work. An example of the type of microphone stand manufactured is illustrated herewith.

The Amrad Corporation announces the publication and distribution to experimenters and servicemen of a booklet entitled "Puncture Proof Filter Condensers" of pocket size.

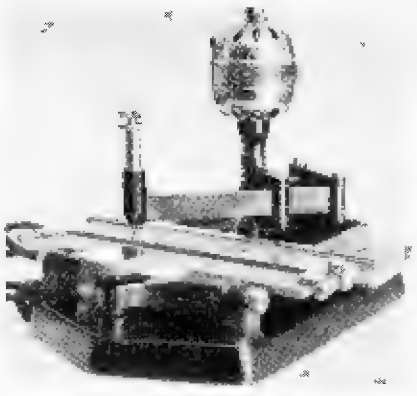
Loud Speaker Terminal Unit

PRACTICALLY all experimenters at some time have experienced the need for a device which would allow them to connect more than one loud



speaker to their radio receiver. Again, others have needed some device which will allow them to compare the relative merits of a number of loud speakers without making elaborate and inconvenient changes of connecting leads with the radio receiver. For this purpose the Insuline Corporation of America has placed on the market a device known as the "Multi-Speaker-Relay."

This unit is merely a receptacle box with a series of pin jacks providing for plugging in tip jacks of from one to four loud speakers, and a connecting cord with pin plugs to connect the unit to the radio receiver. By a switch located on the face of the unit, it is possible to switch from one to the other of the speakers, which are connected to the device, or by placing the switch in such a position that the arrow points in between any two parallel arrangements of tip jacks, it is possible to work two loud speakers at one time.



Panel Engraving Machine

FROM the Simplex Tool Company comes the announcement of an improved engraving machine which will undoubtedly find a ready place in the custom set-builder's and experimenter's work-shop.

The machine is electrically driven by a universal motor and is supplied with a set of bronze master letters and markings which are commonly used in the engraving of radio panels. This engraver will work soft steel, brass, aluminum, hard rubber or bakelite in any width and up to 14 inches in height. Thickness of the material is limited to a maximum of ⅞ of an inch.

By means of the pantograph principle the letters (set up in the engraver's frame) are transferred to the material to be engraved to about ⅓ the size of the master letters.

Sturdy construction is identified with this engraver, which is made of cast steel. A locking screw on the hinged upper section firmly holds the work to be engraved in place, preventing slipping and insuring accurately aligned panel lettering.

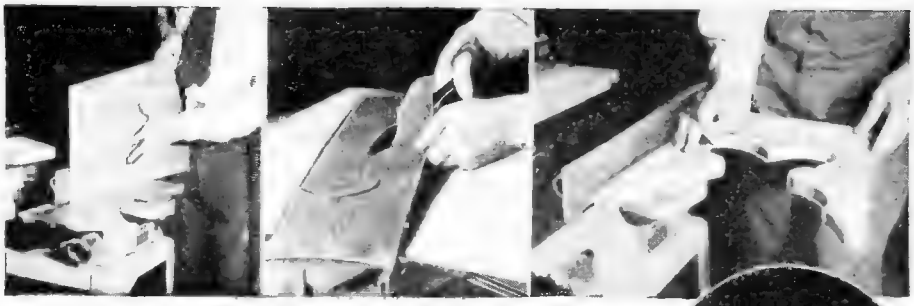
Convenient Radio Flashlight

OFTEN in the repair of a radio receiver in the owner's home the serviceman finds it hard to obtain illumination of parts which are difficult of access. To aid the serviceman, the

Burgess Battery Company announces for distribution a Snaplite Flashlight which is quite small in size. The lamp is lighted when the lid is snapped up and turned off when closed.

Because of its peculiar design and construction the Snaplite may be held in the mouth to illuminate the dark.

The finished table with light in place.



Running edges over the jointer. *Cutting out paper pattern for front.* *Rabbeting.*

A Distinctive Two-Toned Telephone Table

By Gale Vance

Second Prize Winner in Handicraft Contest

IF YOU want a unique, definitely different place to keep the telephone, you might make this table. It is quite nice and will fit into the living room corner as though it has always belonged there—like a brick in the chimney.

Sap gum, selected for freedom from warping and knots, well seasoned and ⅝″ thick, is used. Walnut will give a more satisfactory piece, but then, walnut is more costly and works up a little slower. Sap gum possesses that variety of light and dark adjoining shades to warrant a pleasing effect when the last coat is on. Birch is another excellent material, and so is mahogany in either red or brown. Take your pick.

The side pieces are 20″ long and 16″ wide. Cut a tapered piece from each side to make the top 11¼″ wide. The bottom width remains 16″. Cut these two pieces exactly alike and then run over the jointer, or plane them smooth, making sure that the piece remains square so that a center line drawn from the center of the bottom through the center of the top remains at right angles to both the top and bottom edges. Have one side (the best side) of each piece sanded to remove all traces of a possible wave from a high jointer knife.

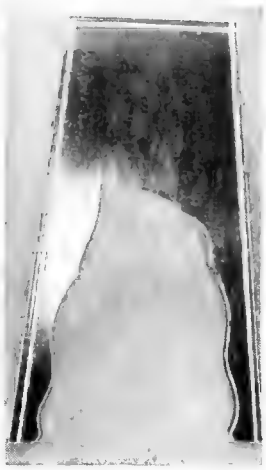
Now trace with a pencil the leg outline shown by the side pattern, retracing the lines with heavier pressure, smooth up any jerky spots and cut out with a band saw. Smooth up by hand, or you can do the work with a garnet paper disc on the end of a flexible shaft or a drum sander on a lathe can be used.

Copy the front and back design on stiff paper, and after folding the paper in the middle (this should first be laid upon the tapered full piece and cut to fit) cut the outline double with shears.

After grooving for the two-tone effect, go over the cut with sandpaper folded as shown, to cut out all the loose fibres of wood.

Here we have a detail of the front section. Note the pleasing balance of the curves.

Inside surface of side section showing grooves for front and back tenons and saw-cut near top to take top metal fasteners.



Corner detail of the front to show groove and tongue relationship.

Detail of one of the side pieces before the final finishing.

Then open flat, and again check the dimensions. This done, lay the pattern upon the piece and trace, then remove and trace again on the other piece. Finally band saw cut and sand smooth enough for the finish with the drum sander.

These four pieces are ready for the stain. If walnut or other porous wood is used a filler coat of the proper color is, of course, required before the stain. This filler is put on rather liberally and after the gloss has disappeared, the surplus is wiped off with a soft rag *against* the grain. Let this dry 12 hours before applying stain.

The stain, too, should dry several hours before going over lightly with No. 00 sand paper or steel wool. Apply stain also to the back surfaces and if walnut is used also fill the back sides of the side pieces from the bottom up two-thirds of the way, as up to this point both sides will show.

Put the set of mold-

(*Cont. on page* 470)

Cutting an edge on the molding cutter for the fourteen-inch-square top.

THE SAFETY

Conducted by

Readers' Opinions and Comments

Dangerous Home-Made Fireworks

IN your issue of July, I notice a page dedicated to the making of fireworks, and knowing the business so well, I hasten to notify you. I have no desire to criticize the writer. Perhaps a man who writes such an article knows something about the scientific side of the business, but the practical side will prove an entirely different story.

The formulas given in the article are most dangerous. They have been abandoned long ago. My grandfather used them in the old country and at one time seven persons lost their lives on account of them. My father used them for many years, up to about 1900, but we were happy to welcome the better formulas, which are safe and give much better results.

For instance, nitrate of potassium and sulphur, when put together, will go off at the least friction. In the making of torpedoes, we generally dissolve them in water and put them together in a liquid form. The better formula for red fire is: 16 lb. of nitrate of strontium, 8 lb. of nitrate of potassium and 3 lb. of shellac. In the gold rain, the better form is saltpetre, sulphur and steel filings.

I am sorry that such formulas were given such publicity. It may cause the life of someone who will attempt to compound them. Fireworks is a very dangerous business, especially the compounding of the compositions and you can rest assured that sulphur and potassium are the two greatest enemies in the business, but if you add antimony to it, then watch out.

LEON PICONE,
Galveston, Texas.

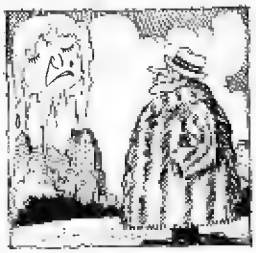
(We have on many occasions made fireworks and have always used the old-fashioned formulas for the purpose. Sulphur and nitrate of potassium were mixed together time and time again and no accident ever occurred. The ingredients were mixed dry, but of course, they were not pounded together. They were merely dumped on a paper and the paper was rolled back and forth.

Sulphur is insoluble in water. Perhaps you infer that you made a paste out of the combination?

The idea of using shellac is not new, and even in those days shellac was employed for the making of indoor fireworks. However, you say nitrate of potassium, combined with sulphur, is dangerous and then give the formula for making gold rain, which comprises saltpetre (potassium nitrate), sulphur and steel filings—quite a dangerous composition, is it not? The making of fireworks in any manner, shape or form, is always dangerous in some degree; even the experts know that.—EDITOR.)

The Heatless Sun

RE Danville W. Starrett, page 890 of your February issue: "The sun has no heat?" Sir Frederick Stupart, head of the Meteorological Department, Toronto, Canada, wrote a lengthy article, published in the Toronto *Daily Star,* claiming the sun was losing its heat—that in a million years or so the world would freeze and all life cease.



I asked Sir Frederick could he prove the sun was a *warm* body — stating that having made a double convex lens of ice through which the sun's rays were focused, I succeeded in burning a hole in the fence without melting or showing any signs of heat on the ice lens. How was it possible to extract sufficient heat from the sun to burn wood and not melt the ice?

It is well known that light is a substance which travels at great speed radiating in straight lines, but when passing through a double convex lens is bent towards the center thus forming a focus. The concentration of all these light rays traveling at high speed, pounding at one spot causes friction which generates heat eventually causing combustible substances to burst into flame.

The rays of light passing through do not heat the lens.

The investigation of light and its refraction for heat should receive more attention than at present is devoted to it. Nature supplies cold which we store up in the form of ice to cool our summer drinks, and nature also supplies great heat, in the form of light, which should and, I believe, will be stored up eventually for winter distribution."

H. A. E. COO,
Toronto, Canada.

Dr. Donald H. Menzel of the Lick Observatory at Mt. Hamilton, Calif., commenting on Mr. Coo's letter, writes:

"Mr. Coo makes no distinction between the various forms of energy. In the atmosphere of the sun there are rapidly vibrating atoms and electrons which send out, much as does a radio station, electromagnetic waves, which we call light. These waves are shorter than radio waves. Now just as a radio wave can elicit a response from a receiver built similarly to the sender, these waves can set atoms into vibration. It is this vibration that we call heat. When the sun's rays fall upon any object that object is warmed thereby. The burning glass simply concentrates the light into a small spot and thereby increases the activity of the molecules at the focus. The sun is hot. The rays of light it emits are not, in the usual sense of the word, hot. Nevertheless, they contain energy. It might be better to say that they are energy, which is able to heat any object that it strikes upon."

Why Does a Chicken Jerk Its Head?

IN a recent copy of SCIENCE AND INVENTION on page 228, there is an article about "Why Does A Chicken Jerk Its Head When It Runs?" Do you mean run or walk? There is a difference about the movement of a chicken when it walks, and when it runs. When a chicken walks, its wings are close to its body and it jerks its head with every step it takes, because it helps to keep its equilibrium. When it runs, its wings are spread out from its body and its neck is stretched forward and it doesn't jerk its head because its outspread wings balance the body of the bird.

If Mr. Dunlap doesn't believe this, let him put a long stiff paper band around the neck of a chicken and let the chicken walk and see what happens.

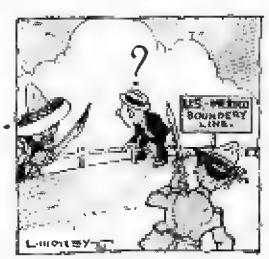
ANDREW PERRY,
New Bedford, Mass.

(Now, Mr. Dunlap, it is up to you or to any poultry fan to prove that the chicken's head jerks are made in an attempt to maintain balance, or for some other reason. The experiment suggested is interesting. Will some of our readers try it?—EDITOR.)

What Is Zero Degrees Centigrade

PLEASE consider this question in your department.

In our high school physics class a discussion arose as to the condition of H_2O, theoretically, at 0° centigrade. I refer to it by the symbol for I know not whether it would exist as ice or water at this ideal temperature. Considering theoretical conditions of atmospheric pressure and absence of foreign matter, water, as you know, freezes at zero, and at the same point ice melts.



Let us take two containers, A and B, and in A put ice and in B put near-freezing water. Suppose it were possible to subject them to the same ideal temperature of zero, all conditions being the same. Now, theoretically, the water would freeze and the ice would melt. So eventually we would have both conditions reversed; thus we would have H_2O existing in both states at the same temperature and under the same conditions.

Please explain how this could be.

L. C. ROUSE, JR.,
Mt. Vernon, Texas.

(The paradox you have outlined has analogies in many other things. A line has length but no width. Suppose a line were to separate two areas. On one side of the line you would be in one area and when you crossed the line you would be in the other area, but to cross the line requires no motion because the line has no breadth. The same is true of the temperature proposition.

Zero degrees centrigrade is the temperature immediately below which water freezes and immediately above which ice melts. It is a definite temperature and has no range or extent any more than the line has. You will find similar paradoxical analogies over the entire field of physics.—EDITOR.)

VALVE

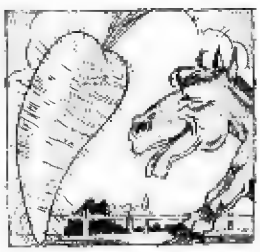
Joseph H. Kraus

Will Be Welcomed by the Editors

The Enlarging Eyes of a Horse

I RECENTLY had an argument about the old superstition that a horse fears man because it sees him ten times enlarged. I say that size is only relative and no eye can enlarge one object and not another. A horse can turn his head around and view his body which would also appear enlarged and so balance proportions. I would be obliged if you would supply me, as an old reader, with the information to convince the other party in the argument.

K. U. KROHNE,
Astoria, L. I.



(Size is, as you say, only relative. Inasmuch as a horse has been brought up (from the moment it first saw the light of day) to recognize articles and objects in its own limited way, the question of size does not enter into the argument. A fly has a great many eye cells in each of which we can see an image of an object. Therefore, some assume that a fly sees thousands of objects at one and the same time. Nevertheless, logic precludes such a possibility, because a fly will travel directly towards the scene of its operation, instead of alighting at a thousand different places.

Any animal, and for that matter even man, fears something strange or worships the strange and supernatural. Horses fear men because they are trained to do so and because they cannot understand man's quick movements. They also fear a cat, or for that matter, a piece of paper that flutters in front of them. A strange horse fears an automobile, an airplane, or a railroad train, but those that are accustomed to conditions in any large city do not shy at a noise.—EDITOR.)

The Growing-Taller Fraud

YOU, no doubt, will be interested to know that Bernard Bernhard and Louise C. Glover, the originators of the neck stretching machine you exposed sometime ago in your Safty Valve Pages, were fined $1,000 each for their mail order fraud. I just read the details in today's San Francisco *News* and hasten to mail you the clipping.

G. G. KRAUSE,
San Francisco, Calif.

(It will be remembered, by the readers of this publication, that a Mr. Bernard Bernhard advertised a device which would make anybody grow taller. This was a sort of a stretching apparatus which fastened under the chin and the cord was then looped over a suitable pulley so that when the patient pulled on the hand grips, his head was pulled upward and his neck was stretched. If the patient did not hang himself in the attempt, he might be (so the advertising reads) inches taller when he got through. Unfortunately, the apparatus had no effect on Bernhard, who measures only five feet four inches. He evidently had never tried it on himself. According to Post Office inspectors, Bernhard, together with Louise C. Glover, his partner, made about $40,000.00 a year in exploiting this fraud through the mails. They were each fined $1,000.00 by Judge A. F. St. Sure for using the mails to defraud—EDITOR.)

A Spiritual Photograph

AS suggested by your Detroit representative, Mr. Lusk, I am attaching this photograph which you will please enter in your contest for spiritual and supernatural manifestations.

While reading your June issue of SCIENCE AND INVENTION, the writer noticed your challenge to spiritualists on page 192. Although the writer does not profess any spiritualistic tendencies, such evidences of the supernatural as the attached photograph portrays argue powerfully for this medium.

I think you will agree that this picture is remarkable in point of expression and poise of the figures in the foreground. In addition, the testimony on the back of the photo is quite authentic and can be easily verified.

Perhaps his challenge to science is too simple for duplication, for often simplicity is the most difficult to master. At any rate, you may enroll his photographic manifestation in your contest that has not, up to date, received an eligible entry.

L. C. HOWE,
Birmingham, Michigan.

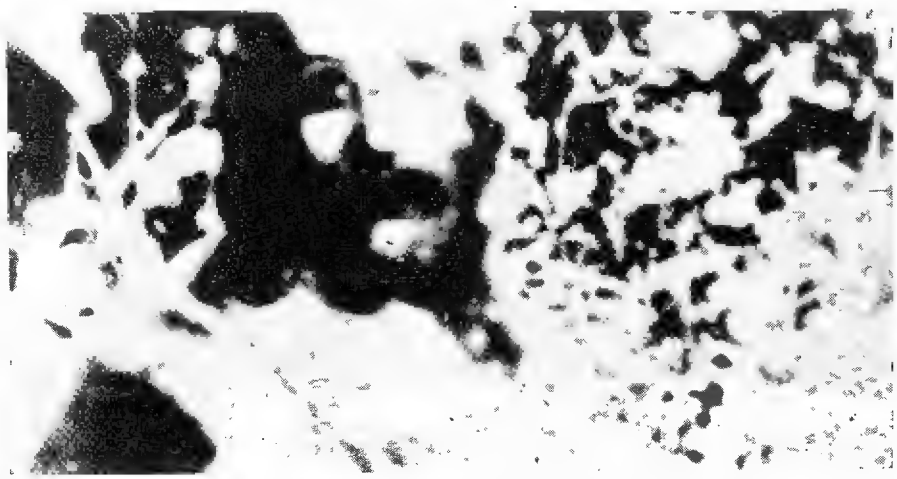
The back of the photograph reads:

"The following incident is absolutely true. Mrs. Jarrett, wife of Howard Jarrett, minister of First Church of the Nazarene at Detroit, Michigan, talked with her friend and neighbor who saw the woman and granddaughter, who were touring through British Columbia. The granddaughter got out of the auto to take a snapshot of a peachtree in full bloom, but the kodak snapped itself three times before she snapped it. She decided there must be something wrong with her kodak, but had the three films developed. The man doing the developing telephoned the girl to come down quickly as there was something peculiar about the pictures. Hurrying down she found No. 1 blank, No. 2 all blossoms and No. 3 as the picture on the other side. Mr. Chamberlain visited Mr. and Mrs. Jarrett in their Detroit home no later than Saturday, May 24, 1930, and they assured him that these are the true facts in the case and can be relied on as authentic."

(We do not deny the testimonial in back of the photograph, nor do we deny the authenticity of the picture. We doubt very much that the photograph is one that actually shows a spirit phenomenon. It is very easy and simple to get results on a negative which will resemble a spirit face, or a spirit picture. Improper or faulty development, or poor film will often produce such an effect. If you take the picture of a cloud formation, you will undoubtedly see, somewhere in those clouds, something that resembles a man or an animal. Surely, you do not hold that this cloud formation is spiritual? Why then do you suppose that leaf and tree shadows have a spiritual inference? We can make out five or six faces, a rabbit, two cats, a bear, a calf, a frog, a jellyfish, a mouse, a man on horseback, and —use your imagination. Are there spirit mice, frogs and jellyfish?

If you, or any other individual, will duplicate for us a spirit picture, similar to the one that you have submitted, against a neutral background, on condition that we can examine the camera and we can supply the films, or plates, which films or plates, will be loaded by any photographer in a dark room from a freshly sealed and unprepared package of films, or plates, $1,000.00 of our $21,000.00 contest will be yours, on condition, of course, that no trickery enters into the making of the picture.

If you are prepared to produce such an effect, we shall be very glad to entertain you and make all the necessary arrangements. We do not hold that this picture is fraudulent, nor can you expect us to believe that it is spiritualistic.—EDITOR.)



What happened when foliage was photographed.

MAGIC*

By Tunninger

HERE is a new impromptu method of causing a lighted cigarette to vanish from the bare hands. The cigarette in question is really a paper tube made of lightweight non-transparent white paper. The magician while apparently smoking is actually blowing smoke through the tube. This smoke he obtained from another cigarette that he, the moment before, placed on the table behind him and which he will pick up in making the cigarette appear again. In the act of vanishing the cigarette, the paper tube is crumbled and concealed.

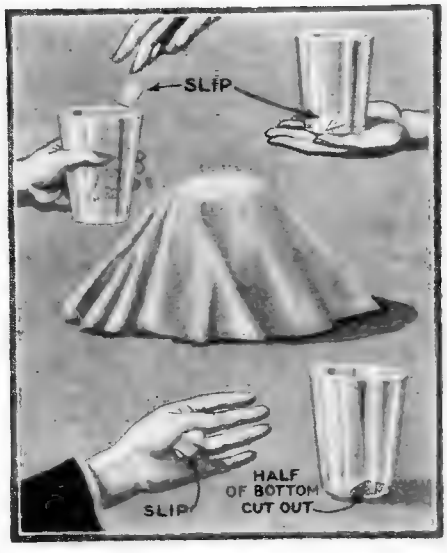
Color-Changing Balloon

IN this original effect a large red toy balloon is held in the performer's outstretched hand. An assistant fires a pistol directly at the balloon and instantly the red balloon changes its color.

The secret lies in the fact that two balloons are used. A blue balloon is put inside of a red toy balloon. The blue one is now blown up. The red one is, of course, distended during this act. The blue balloon is now tied and the tied neck is pushed inside the red balloon. The red balloon is then further inflated, so that it is about an inch larger in diameter than the blue. This one is also tied. At the report of the pistol, the magician pierces the outer balloon with a pin that has been soldered to a band, worn on the finger.

Thought Reading

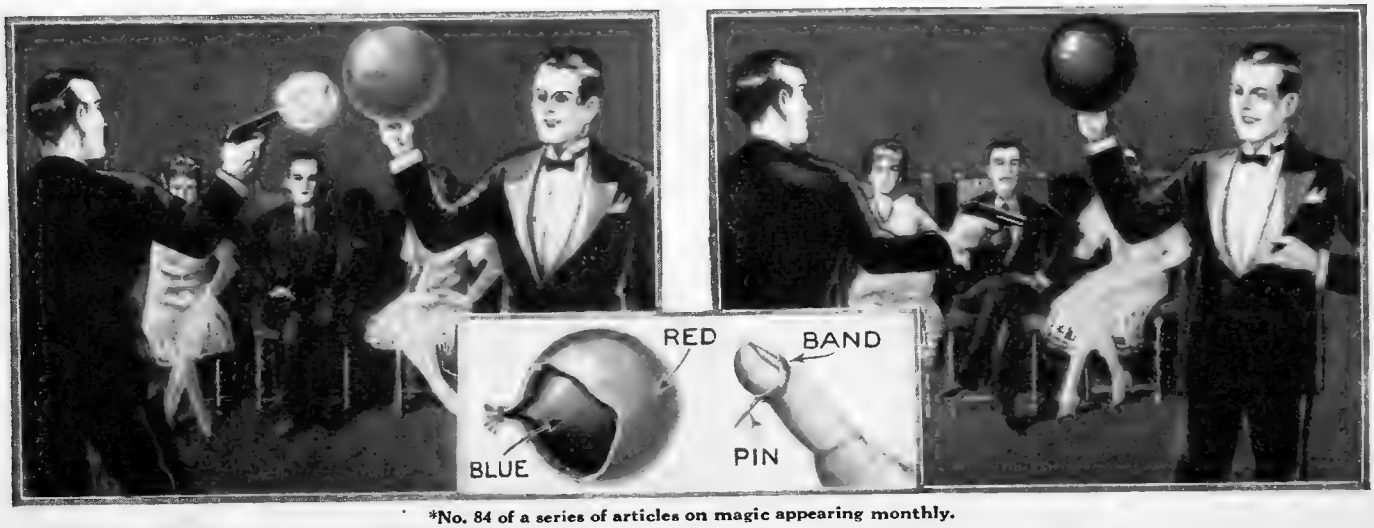
MIND reading tricks are always popular with present-day audiences. This is an original method of presenting an effective and mystifying billet test. A piece of paper approximately two by three inches is handed to a spectator, with the request that he write his name, address, phone number and any question he would like answered on the slip of paper. After the billet has been folded several times, the mind reader



steps into the room and, taking the billet between his thumb and forefinger, drops it into a tumbler. Then the glass is covered with a borrowed handkerchief. Standing at some distance, the mind reader writes the exact name and address on a slate or writing tablet. When the handkerchief is lifted from the glass, the original billet is still found in it. The secret lies in the glass. One-half of its bottom is cut away. When the billet is dropped into the glass it comes to rest on the bottom, but when the glass is covered with a handkerchief it is tipped so that the billet slides into the performer's hand. He can secretly unfold this while writing upon the slate, read the contents, refold the billet, and while unveiling the glass slip the folded paper up through the bottom again.

Card Changes Character

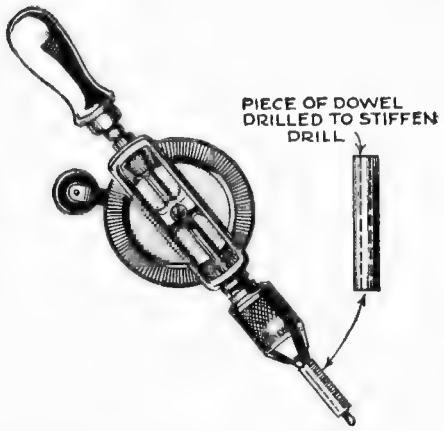
AN envelope just large enough to fit a card is passed for examination. The corner of this envelope has been cut away. A card freely chosen from the deck is also given to the magician. He slides this into the envelope and seals the same. He now requests a spectator to sign his name across the seal; then in full view of the audience, he turns the envelope so as to bring the card face upward. Apparently the pip shows, and the audience is convinced that by this it can identify the card. Explaining that it would be humanly impossible to change the card in the envelope, the operator asks the spectator to tear the envelope open and shows that such a change has actually taken place. The secret lies in the fact that a small corner pocket made from another card is secretly slid over the exposed corner.



*No. 84 of a series of articles on magic appearing monthly.

Try These in Your Own Workshop

Here Are Six Valuable Hints and Suggestions for the Home Workshop Enthusiast

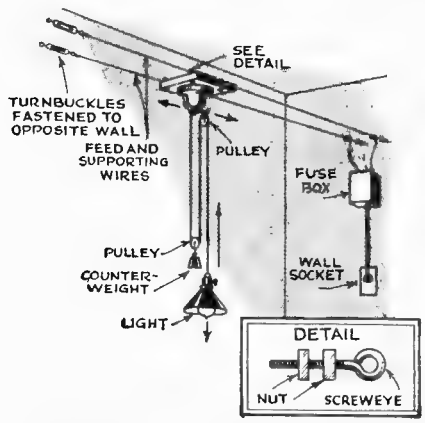


A Dowel for a Drill

MANY times in using a small hand drill, snap goes the drill! Or, when pressure is exerted, the shank will bend and never run true again. This can all be avoided by slowly drilling through a wood dowel slightly shorter than the drill and leaving the dowel in place so that most of the drill will be covered.—*Walter B. Burlingame.*

Sliding Electric Lamp

STRETCH two copper wires (No. 14 copper bare wire or two lengths of aerial radio 7 strand wire) across the workshop, as near the ceiling as possible to avoid touching the wire while working and receiving a shock. Two turnbuckles (15c in any hardware store) are excellent for stretching the wires. At one end the wires connect with the electric light wires. At the



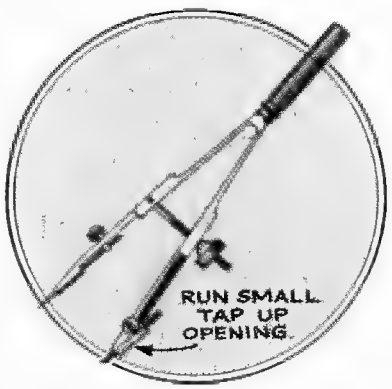
other end they are held by insulators.

The slide supporting the light is made of a piece of hard wood about six inches square, hung from the copper wires by four screweyes. The wire is passed through these screweyes. A nut on either side of the wooden square holds each of the screweyes in place, but is really not needed.

Screw an electric rosette to the square of wood and connect one lead to the one wire and the other to the other wire. Connect your light as usual; either have an extension light held in place by a weight, or place a socket directly on the wooden square. Protect the apparatus by two fifteen ampere fuses.—*J. McGouth.*

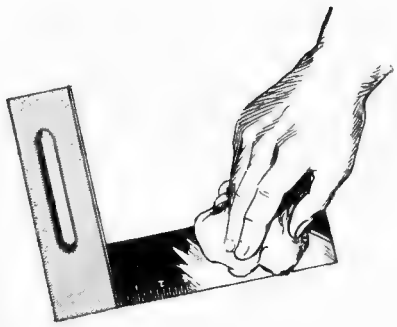
Keeping Lead from Slipping

ONE common annoyance to the draftsman is to have lead in a bow pencil slip up under a little pressure while drawing a heavy line. This



trouble can be easily overcome by roughing up the inside surface so that the metal, when tightened, will grip the lead. The simplest way to do this is to run a small machinist's tap up the opening, thus threading the inside surface. It will not only prevent lead from slipping, but will allow for careful adjustment of the lead when it becomes short. By turning the lead one or more revolutions it moves up or down the thread an equal amount for each turn.—*Raymond K. Wilson.*

Brightening Up Figures on Tools



WHEN figures on a carpenter's steel square, or other tools having indented lines and figures become dull and hard to read, they may be brightened up by rubbing a coat of white lead over the surface and immediately wiping it off. The figures and indented lines will retain the white lead while the smooth surface wipes off clean.—*James W. Havener.*

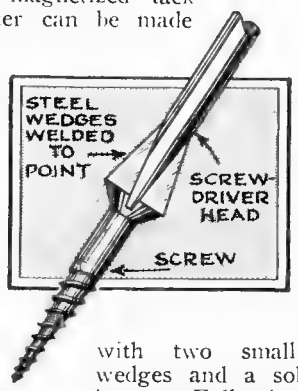
Canvas Roll for Tools

A CANVAS roll for drills and other tools can be made from an ordinary piece of canvas and an old window

shade roller. Cut the spring end of the roller to fourteen inches in length, and attach the canvas to it. Be sure to make the canvas as the drawing shows, to provide for spaces for the drills. Then put a clip on each end of the roller. The canvas when rolled up with tools inside will be bulky; so to make sure the roll will have sufficient clearance, nail a wooden block, about 2″×4″, to each clip. The block can then be fastened to the wall or bench.—*R. C. Petty.*

To Make a Magnetic Screwdriver

A MAGNETIC screwdriver that functions on the same principle as a magnetized tack hammer can be made



with two small steel wedges and a soldering iron. Following the drawing, file the wedges down so that they will fit the point of the screwdriver evenly and then solder or electric-weld them in place. Magnetize the end by rubbing against the pole of a permanent or an electro-magnet a few times. Always rub in the same direction. You will find that small screws can be picked up and started in a wood surface. It is most satisfactory for use with small flat-headed screws.—*Kenneth Bronaldo Murray.*

Fig. 1—Cutting bottom design.

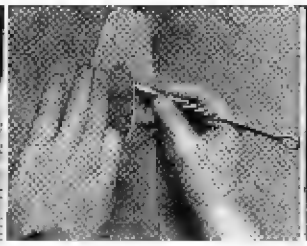


Fig. 2—Using template to scribe line.

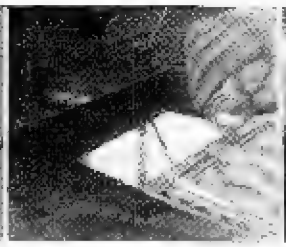


Fig. 3—Building dam for acid.

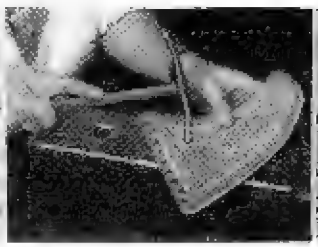


Fig. 4—Obtaining the hammered effect.

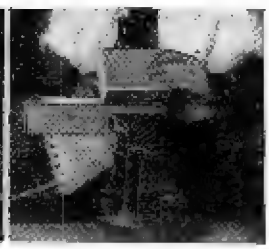
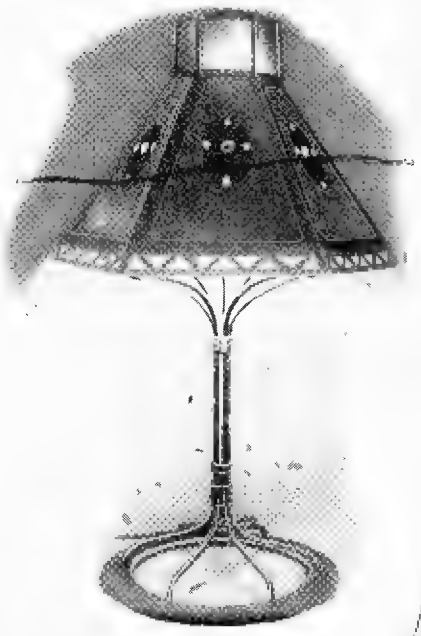


Fig. 5—Bending the edge with block.

Make a Jewelled

Attractive Lamp with Unique Changeable Features Which Make It Always Modern

First Prize Winner in June Handicraft Contest



Your finished lamp will look like this.

Silhouettes, modernistic designs, or photographs can be displayed in the top tower.

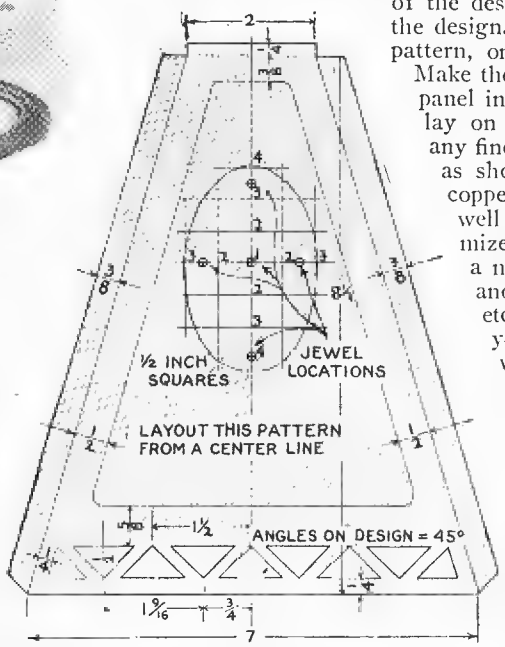
HERE is an interesting lamp, quite different from any that you can buy. The tower is an attractive feature that permits the display of photographs, colored plates, or silhouettes mounted on parchment paper. A low wattage bulb, used to illuminate the plates, also serves as a pleasing night light. The design is such that it permits of several changes. You may omit the jewels or the color tower, although each is a feature of the lamp.

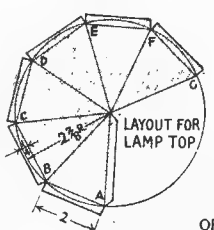
You will need for this job a piece of copper, 18 inches by 30 and preferably 32 gauge. Ten feet of ¼ inch hexagon brass or copper rod, some lead, felt, a piece of 1 inch band iron, the necessary sockets and wiring, jewels and color plates or snapshots. You can get very interesting effects in the tower by using parchment paper on which you put a silhouette or colored transfer patterns used for furniture decoration.

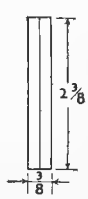
Buy the jewels at a variety or 5 and 10 cent store. You will be surprised at the variety and inexpensiveness of the glass stones you can get in the costume jewelry. Of course, be sure to get transparent and not opaque stones.

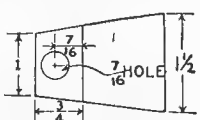
Now let's get started on the lamp. It will be to your advantage to first make full-sized drawings on plain yellow drawing paper of all of the detail drawings accompanying this article.

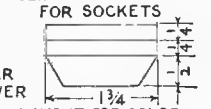
First let us make the shade. Cut the six required panels from the copper. On each panel lay the detail drawing with carbon paper and transfer the triangular design on the bottom of the shade. Remark the carbon lines with pencil and drill a small hole for a scroll saw in each space. Now with a scroll saw fitted with a metal cutting blade, saw out each space of the design as shown in photo 1. File the edges of the design very carefully. Next it is necessary to etch the design. Make templates of the design from your paper pattern, one for the oval and another for the outer line. Make these from either tin or heavy cardboard. Dip your panel into a pan of hot wax. When the panel has cooled lay on the templates, and mark with a scratch-awl or any fine point that will cut through the wax to the copper as shown in Fig. 2. You are now ready to etch the copper but it would take quite an amount of liquid as well as a large dish to etch the panel so we can economize by building a dam around the outer edge. Cut a narrow strip of metal, bend it just outside the line and pour wax to form the dam, as in Fig. 3. Use an etching solution of three parts of water into which you SLOWLY pour one part of nitric acid. This will etch into the copper. When the panel is etched deep enough, pour off the acid, wash with

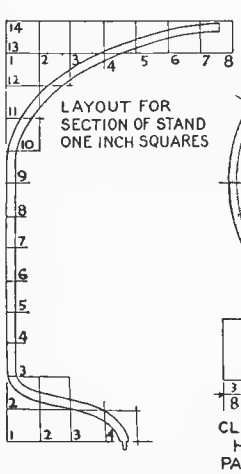


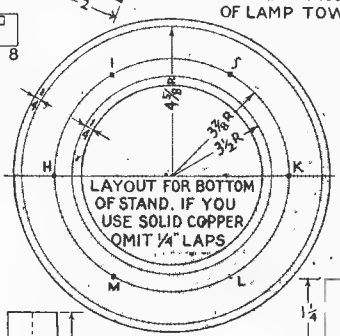


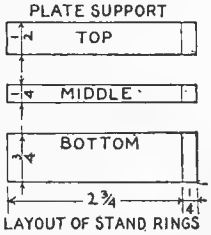


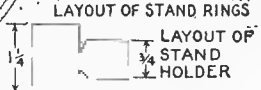












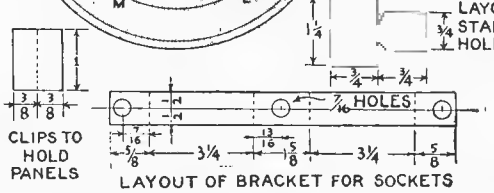


Fig. 6—Locating jewels.

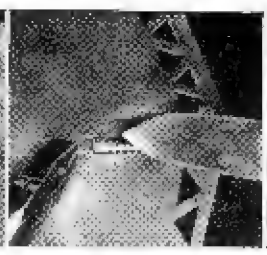


Fig. 7 — Soldering clips in place.

Fig. 8—Making sharp bends.

Fig. 9 — Bending long sweeps.

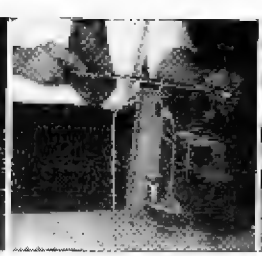


Fig. 10—Sawing a shoulder.

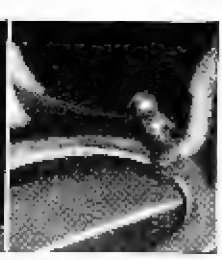


Fig. 11 — Hammering ring bevel.

Table Lamp

By John Steinke

water and melt off the wax. Then with any small round-headed hammer put the hammered effect between the etched lines as shown in Fig. 4.

Before you bend the edge, anneal the copper by getting it red hot and plunging it into water. Clamp the panel between two boards in a vise and tap the edge down with a third board hit with a hammer. This is shown in Fig. 5. This will only give a right angle and you need more. Hold the panel at the edge of a bench and carefully tap it over until you get a 60-degree angle.

Your layout of jewels of course will depend upon taste and it is not necessary that every panel be alike, though they should be somewhat similar. Place the jewels within the oval as best suits the size and number of jewels you selected. Hold them down with the rubber on a pencil while you trace around the jewels with a scribe. (Fig. 6). Drill small holes in the center of each jewel opening. Cut just within the line so that the hole is smaller than the jewel. Scratch a number inside each panel and put each set of jewels in a correspondingly numbered envelope. Bevel the jewel holes with a file inside the panel so they will hold in snugly. Do not put the jewels in, until the lamp is finished.

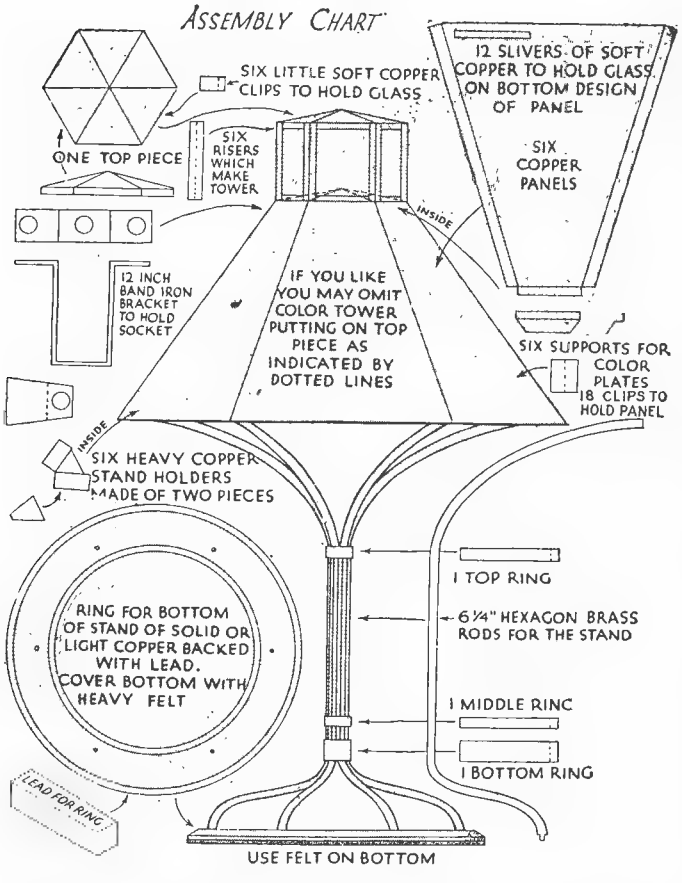
To assemble the shade bend a clip with your fingers and clamp it tightly over the edges of two panels. Be sure that the tops and bottoms of your panels are kept even. Solder the clip tightly as shown in the close-up in Fig. 7. Repeat this at the top of the two panels leaving the center clip go until the shade has been completely assembled. Assemble two sections of three panels each and then finally assemble the shade.

When you are soldering copper it will be much easier if you will tin the pieces to be soldered before you put them together. This is easily done by putting on soldering flux and flowing on solder.

Now cut the top piece according to your pattern and carefully bend the edges with pliers or over a block. If you are not making the tower, solder the top directly on top of your assembled shade. Do all soldering on the inside of the shade.

If you are making the tower cut

(*Continued on page 468*)


ASSEMBLY CHART
SIX LITTLE SOFT COPPER CLIPS TO HOLD GLASS
12 SLIVERS OF SOFT COPPER TO HOLD GLASS ON BOTTOM DESIGN OF PANEL
ONE TOP PIECE
SIX RISERS WHICH MAKE TOWER
SIX COPPER PANELS
INSIDE
12 INCH BAND IRON BRACKET TO HOLD SOCKET
IF YOU LIKE YOU MAY OMIT COLOR TOWER PUTTING ON TOP PIECE AS INDICATED BY DOTTED LINES
SIX SUPPORTS FOR COLOR PLATES 18 CLIPS TO HOLD PANEL
INSIDE
SIX HEAVY COPPER STAND HOLDERS MADE OF TWO PIECES
1 TOP RING
6¼" HEXAGON BRASS RODS FOR THE STAND
RING FOR BOTTOM OF STAND OF SOLID OR LIGHT COPPER BACKED WITH LEAD. COVER BOTTOM WITH HEAVY FELT
1 MIDDLE RING
1 BOTTOM RING
LEAD FOR RING
USE FELT ON BOTTOM

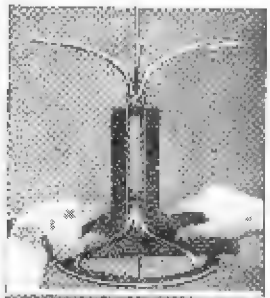


Fig. 12—Squaring lamp stand before soldering legs.

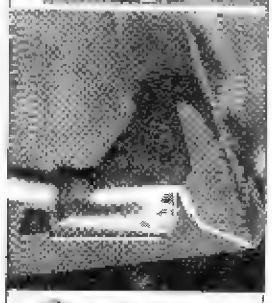


Fig. 13—Closeup of stand holder on the shade.

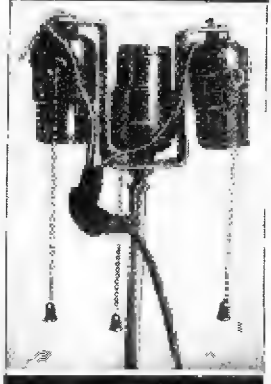


Fig. 14—Closeup of socket bracket holder. Bracket holder is removable.

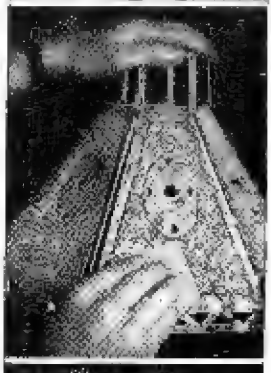


Fig. 15—After metal is chemically colored, sand off high spots.

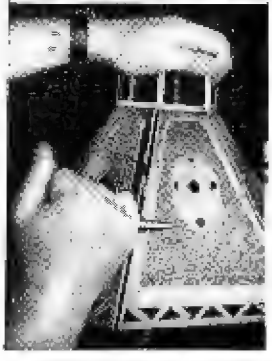
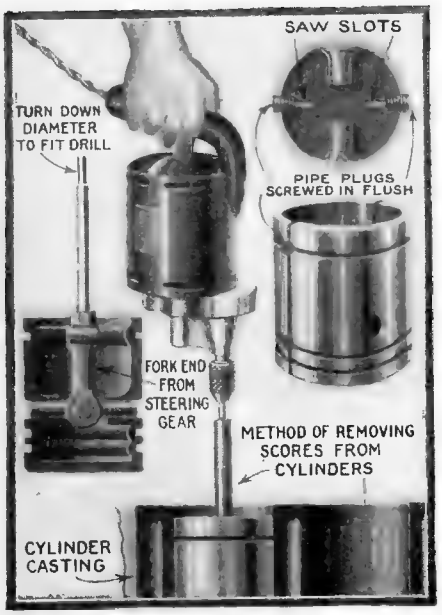


Fig. 16—To get a higher luster, burnish the copper with smooth steel tool

New Ideas for the Owner *and* Driver

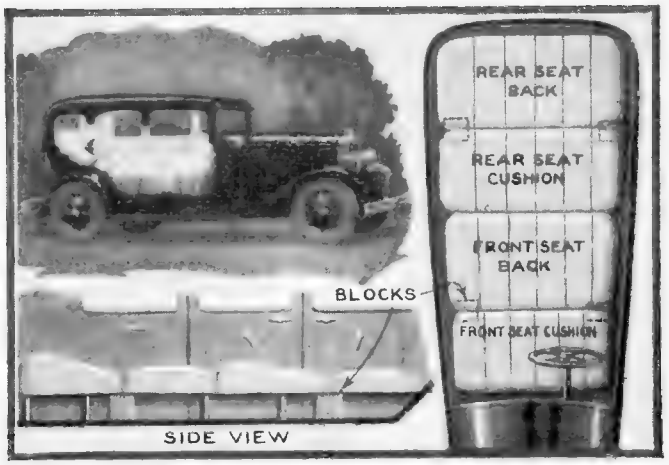

SAW SLOTS
TURN DOWN DIAMETER TO FIT DRILL
PIPE PLUGS SCREWED IN FLUSH
FORK END FROM STEERING GEAR
METHOD OF REMOVING SCORES FROM CYLINDERS
CYLINDER CASTING

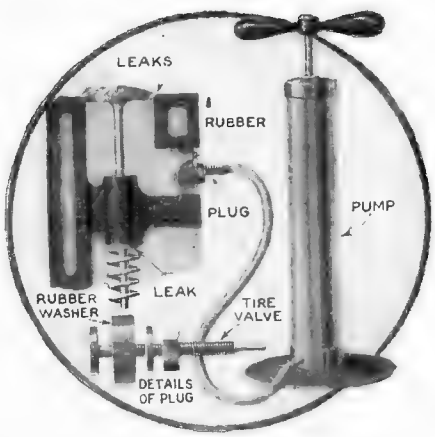
For Lightly Scored Cylinders

LACK of oil, broken rings, or a broken oil pump, are causes frequently resulting in cylinder scores. Should the owner desire to rebore, he can use the following system. An old piston is split on each side with a hack saw, and is expanded with one-quarter inch pipe plugs screwed in flush. An old steering gear fork is fitted loosely to the wrist pin, so that the piston can be turned. The end of this fork is turned down to fit the chuck of an electric hand drill, which rotates the lap. Coarse emery is used at the start of the lapping operation, and grinding compound or flour of emery is used at the finish.

An Auto Bed

TO convert an auto into a bed, all the cushions must be unbolted, but many cars are provided with seat backs that are easily detachable, so that this job, in most cases, will not be difficult. Should the seats in your car be solid, any body repairer can make them detachable and provide thumb screws for their removal. The arrangement of the cushions is such that they all are placed flat. Wood blocks are provided to make the cushions level.



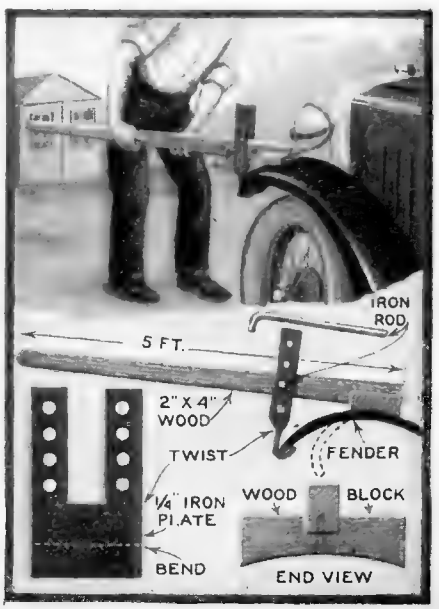


Testing Valves for Leakage

TO test warped valve heads, bent stems, and worn valve guides, or to test the tightness of valves after grinding, and for leakage at the stem, a simple system can be rigged up by any owner in a few minutes. The stem of an inner tube with the original sealing nut and washer is fitted with a larger rubber washer. The nut, when tightened, expands the rubber and makes a tight joint in a valve port. A tire pump is then used to force air into the port, and bubbles, showing in a drop of oil around valve or stem, show leakage.

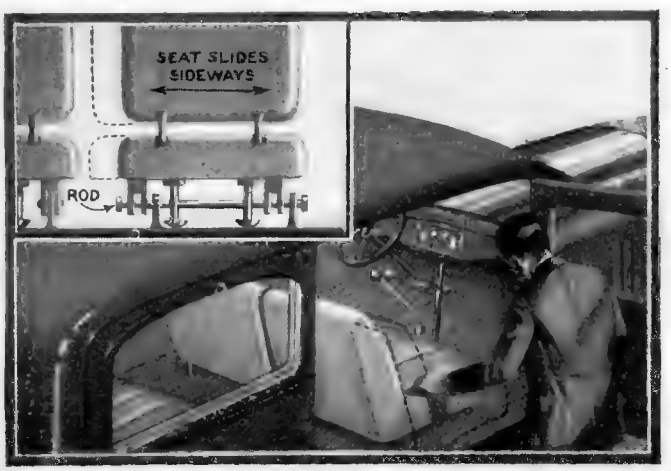
Straightening Fender Bends

THE tool consists of a wooden bar made from a two by four, and fitted with a concave wooden block and hook-shaped one-quarter inch iron plate. Keep a rag or waste under the points of contact with the fender to prevent scratching.



Making Room for Back-Seat Riders

WITH the two-door sedan type of car, it is necessary for the occupant of the right front seat to step out in order to make room for those passing to or from the back seats. A simple alteration will eliminate this difficulty. The hinging pins from the forward swivels are removed, and a solid rod wider than the spacing lugs is substituted. By this means, the occupant of the right front seat can quickly slide sidewise, toward the driver, leaving plenty of room for exit of the party vacating the rear seat.



Modernistic End Table, Smoking Stand and Rack from Packing Boxes

Wouldn't you like to relax in an easy chair, with this snappy end table for your smokes, candy and books? And it's quite simple to make when you follow this working drawing.

By Edwin T. Hamilton

MANY of us would like to make our own end tables, magazine racks, and smoking stands. But we have neither the time nor money to master the more complicated forms of construction. Furniture in the *mode moderne,* however, is vastly easier to make. It is ideal for the amateur handiworker, for simplicity is the keynote, and troublesome curves are lacking. How often do we split up packing boxes for feeding the fireplace, or leave them stored in our basements? These will serve as material for the latest style furniture, which, with its straight lines and square tendencies, may be considered an evolution of the box. And if we do not want to use boxes, any kind of wood can be used. Common yellow pine box lumber is, however, the lowest in cost, and easiest to obtain and work with.

End Table

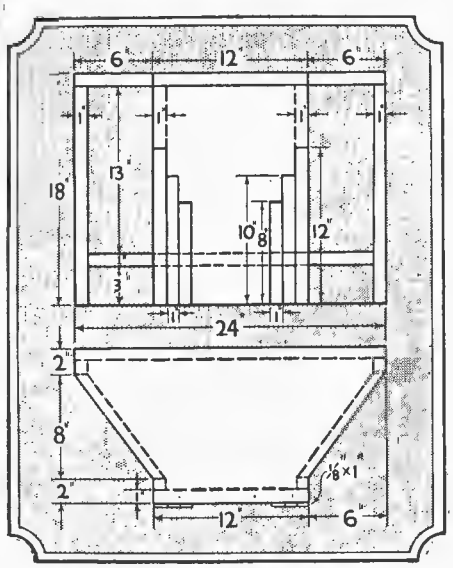
This is constructed of 1″ stock throughout, with the exception of the decoration strips, which are ⅛″ stock. The back is solid, measuring 17″ high and 24″ wide. If stock of this size is obtainable, it will be found best, but if not, the 24″ width can be obtained by using two 12″ wide pieces.

The front is constructed of a piece measuring 17″ high and 12″ wide. The top is cut to shape from stock measuring 12″×24″. The shelf, being 1″ smaller all around than the top, can be cut from stock measuring 10″×22″.

Four 1″ sq. legs, each 17″ long, are now cut. Make sure that all edges are square, when these pieces have been cut to their proper size and shape. Sand smooth.

In assembling the table, 1½″ small-head brads and hot carpenter's glue are used. Use a nail set on all nails. Remove all traces of excess glue when thoroughly dry, filling nail set holes, joints and blemishes in the wood with plastic wood, and finish smooth by repeated sanding. All parts are both glued and nailed.

The decoration strips are easily made from wood lath, and should be finished



in pairs, assuring perfect duplication. Plane the lath to a thickness of ⅛″, and a width of 1″. Cut two pieces 8″ long, and two 12″ long. It is not necessary to nail these pieces, as hot carpenter's glue will hold them firmly. When perfectly dry, remove excess glue, and treat the entire table to a thorough sanding.

For finishing instructions, see those given on the smoking stand. A black top and shelf, with the balance in Indian yellow, will be found most effective.

Smoking Stand

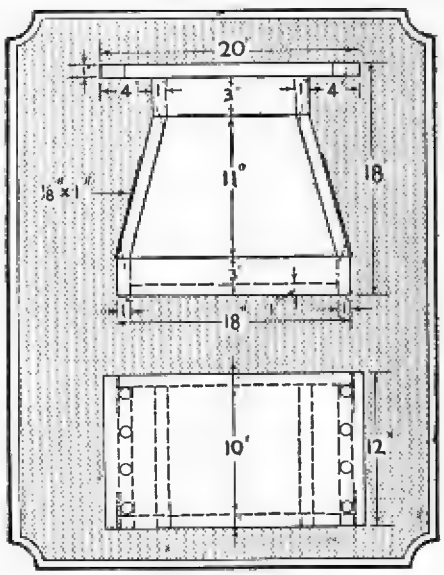
This is also constructed of 1″ stock throughout, with the exception of the side decoration strips, which are ⅛″×

Here's a smoking stand in the mode moderne. Just the proper size for comfortable reaching. Details sketched above will help you construct one.

1″ strips. The top measures 12″×20″. Four 1″ diameter holes are bored through it at each end, which form an ideal pipe rack for eight pipes.

The back is made solid, from one piece, if obtainable, and cut to size and shape from stock measuring 17″×18″ long. Each side is constructed from three pieces, two of which measure 3″ wide and 10″ long. The third and center piece is 10″ wide and 11½″ long. This piece must have both its ends beveled to fit the top and bottom side pieces.

The front is also constructed of three pieces, one of which forms the cupboard door. The top piece of the front is 3″×12″ long, the corresponding bottom piece measures 3″×18″. After the stand is assembled the cupboard door is cut



to size and shape to insure a perfect fit. It can be cut from stock measuring 12″×16″ long. The bottom of the stand is 10″×16″. Cut each of these pieces to proper size and shape, and finish by sanding.

In assembling the stand, use 1½″ small-head brads and hot carpenter's glue on all parts. The top and bottom side pieces are toe-nailed to the center side pieces, as shown in the plans. When the entire stand has been assembled, cut to size and shape the cupboard door. Two 1″ hinges are now attached to the bottom edge of the door, as shown. Before attaching the hinges to the bottom front piece, test the door to see that the fit is snug enough to insure its (*Continued on page* 461)

Let's Laugh

ALL jokes published here are paid for at a rate of $1.00 each; $3.00 is paid for the best joke submitted each month. Jokes should be scientific. Write each joke on a separate sheet of paper and add name and address to each sheet of paper.

TRULY DEFINED

CHEMIST—What causes an earthquake?

STUDENT—Gravitation.

CHEMIST—How can that be?

STUDENT—Two objects are going high in the air on different parts of the earth's surface; the earth tries to meet them both; result, a violent shock called an earthquake.

—*Lorraine Zickefoose.*

IT TAKES TIME

"Does it run?" asked Joe, looking sympathetically at Bill's run-down Lizzie.

"Run? Why, man, the darn thing ain't learned to walk yet!"

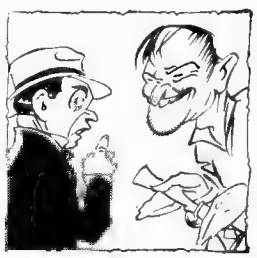
—*John J. Miller.*

HABIT IS DANGEROUS

Then there's the ex-motorist who got out of his airplane to look at a puncture.

—*Jerome McCabe.*

DEFINITION



BYSTANDER—Oh, you've committed murder!

KILLER—Murder hell! He committed suicide; I told him I was going to shoot and he didn't duck.

—*John J. Dipieralo.*

DRIVING WITH BRAINS

FRIEND—Say, Bill, why do you always hit your horses on one side?

TEAMSTER—I figure if I get one side going, the other side is pretty sure to follow.—*Dorothy Upperman.*

FIRST PRIZE $3.00
WHEN A MAN'S A MAN

JONES — Describe your sister's new baby.

BACHELOR BROWN — Small features, red faced, clean shaven, and a hard drinker.

Leslie F. Carpenter.

REQUITAL

There was once a man who was scheduled to give an after-dinner speech. He suddenly became ill, and was operated on . . . his brain was removed.

The surgeons withdrew to a corner of the room to discuss angles of the case. When they returned, the patient was gone. They were frantic. Not a stone was left unturned to find the man without a brain.

Finally he was found. And where do you think he was? At the banquet, giving his after-dinner speech!—*D. Glade.*

GUILTY OR NOT GUILTY

TEACHER—Who signed the Magna Charta?

YOUNGSTER—Please, ma'am, 'twasn't me.

TEACHER (disgustedly) — Oh, take your seat.

SKEPTICAL MEMBER OF SCHOOL BOARD—Here, call that boy back. I don't like his looks. I believe he did it.

—*Katherine M. Krohn.*

PASS TO THE FOOT OF THE CLASS!

JOE—How were your grades last quarter?

KAP—Jules Verne.

JOE—How's that?

KAP—Twenty thousand leagues under the C.

—*John J. Dipieralo.*

FAILING MEMORY

DOCTOR—So you have severe headaches, pains in the back and bilious attacks. H-m, and what is your age, madam?"

ELDERLY PATIENT—Nearly 35.

DOCTOR (muttering to himself)—And loss of memory, too!

Estelle C. Laughlin.

EMBARRASSING

While on his vacation the zoo director received the following note from his chief assistant: "Everything is all right, except that the monkey seems to be pining for a companion. What shall we do until you return?"—*Roland Nelson.*

CORRECT!

BOY—What animal is satisfied with least nourishment?"

BRIGHT SISTER—The moth, it eats holes.—*William A. Freeman.*

TIME TO RE-CHARGE

MOTHER—Our son at college is getting to be quite a live wire."

DAD—Yes, he charges everything.

—*R. L. Eyrich.*

AIR MINDED

He is so dumb, he thinks AROMATICS are air stunts.

—*Harvey Kurtz.*

Scienty Simon—*Scientist*

HERE'S WHERE I MAKE MY OWN. SODA-WATER --- SOME BICARBONATE OF SODA -- SOME ICE WATER --- SOME NICE STRAWBERRY JAM ---
--- MIX THEM ALL TOGETHER --- SO --- AND THEN ---
JAM
GUGGLE -- GUGGLE --- BLUB --- GUGGLE ---
PHEW!
W. LEMKIN
SCIENCE LESSON No 46
THERE IS NO SODA IN SODA-WATER!... IT IS MADE BY DISSOLVING CARBON DIOXIDE IN WATER UNDER GREAT PRESSURE. WHEN THE PRESSURE IS RELIEVED THE GAS ESCAPES FROM THE SOLUTION IN THE FORM OF BUBBLES - IT IS THESE BUBBLES THAT PRODUCE THE TICKLING SENSATION IN THE THROAT WHEN YOU DRINK A CARBONATED BEVERAGE : PERHAPS THE NAME SODA-WATER COMES FROM THE USE OF BICARBONATE OF SODA TO PRODUCE THE CARBON DIOXIDE WITH WHICH THE BEVERAGE IS CHARGED

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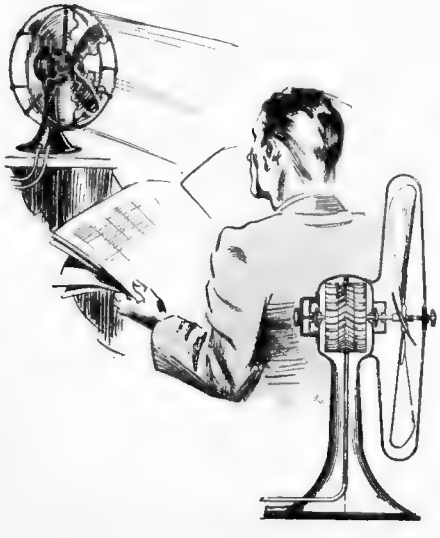
Yankee Brains *at* Work

"Canning" the Fuel Can

No. 1,748,323, *issued to Louis V. Aronson. The invention relates to pocket lighters, such as are commonly used for lighting cigarettes. The object of the invention includes a provision of a simple and dependable means of charging the lighter with fuel. It consists of a specially arranged lighter, having a chamber for holding fuel, ignition devices, a wick extending into the chamber, a fuel cartridge having an open end. The chamber has an opening in the wall for the insertion of the cartridge. The fuel cartridge has a cover for its opening, and a member passes through this cover for controlling the passage of the fuel from the cartridge into the surrounding chamber space.*

An Accommodating Water Fan

No. 1,742,366, *issued to Masa Nagao. The object of this invention is to provide a hydraulic fan which will give a cool and refreshing draft of air during a long and continuous use from the fan. It consists of a hollow stand comprising various gears, shafts, etc., including a water-operated turbine. The motor parts of the fan are continually cooled by water, thus obviating the heat given off by fans powered by other types of motors.*



Notice to Readers:

AN appreciable period of time elapses between the filing of a patent and the date upon which the patent is granted. During this interval inventors frequently move. We regret that it is quite impossible for us to supply the correct addresses of persons whose inventions appear on this page, nor can we furnish information about when the product may appear on the market. Attorneys who prosecuted the patent cases can furnish the most reliable data. Copies of patents are available at ten cents each from the U. S. Patent Office, Washington, D. C.

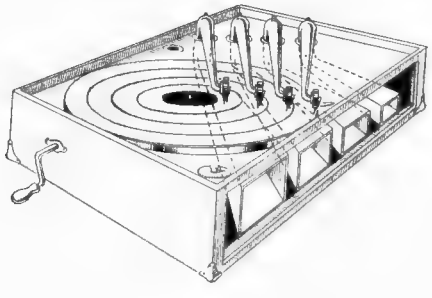
Sugar-Dispensing Bowl

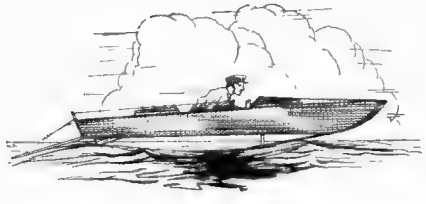
No. 1,756,002, *issued to Louis Nagy. This patent covers a sanitary sugar bowl for counter or table use that will automatically deliver an apportioned amount of granulated sugar whenever the operating handle is rotated. As will be observed, the device consists of a closed chamber bowl. The granulated sugar can be inserted through a suitable opening in the top. Inside, there is a rotatable disk which can be turned by the knob with which it communicates. This disk has a series of recess chambers which are each filled with sugar as the disk is rotated, and which discharge the sugar whenever one of the chambers passes over the outlet spout. A means is provided for pulverizing any lumps within the sugar before the sugar enters the measuring part of the disk.*

Multi-Sound Chamber Phonograph

No. 1,752,357 *issued to Hugo Wiener. This invention relates to an improvement in phonograph construction and provides a multitude of reproducers, each of which communicates with a separate sound chamber. The sound chambers vary in both length and size of the openings and with a slight variation in the reproducers each will respond more acutely to the sound nearest the fundamental of the horn. The records used on this phonograph will be divided so that each set of grooves will be for the reproduction of either a certain member in a quartet, or a definite instrument in an orchestra. The tones, when originally recorded upon the record, are registered separately, but at the exact starting position, so that when reproduced there will be four separate tones harmonizing together. In this way one singer can be made to sing a quartet.*

We are inclined to believe that unless a special starting arrangement were provided, an individual might experience difficulty in using this type of phonograph.





Varying the Steps on the Hulls of Speedboats

No. 1,752,406 *issued to Paul Wetch. Hulls of speedboats are usually made with steps to reduce the frictional area of the boat with the water. The inventor of this system has developed steps which are adjustable and which are made in sections so that a part of the step can be lifted. This action removes a corresponding frictional area from contact with the water and allows the craft to gain in progress and show better speed. By operating levers in the boat the steps can be adjusted directly from the driver's seat. Instead of having the step extend in a single body from side to side, the same is divided into two laterally spaced sections between which there is a separate movable filler. The same construction can also be provided at the rear step.*

Answers and Prize Awards in June Puzzle Contest

By Sam Loyd

Solution to "Piles of Money" Problem

IN a geometrical progression proceeding from unity, and with the constant multiplier 2, every number consecutively from 1 to a number equal to the sum of the terms, may be represented by a single term or combination of terms.

Such a progression, of nine terms, would exactly solve our problem were the total number of dollars in the teller's nine piles 511 rather than 500. The series would be: 1, 2, 4, 8, 16, 32, 64, 128, 256. Reducing the last term to 245 would fit the series nicely to our purpose were we not reminded of the further condition that one of the piles should contain the largest possible number of dollars under the circumstances. Obviously, the largest pile could not contain more than 250, for if it were 251, or more, the sum of the preceding terms would be 249, or less, and thus it would not be possible to produce the numbers between 249, or less, and the amount of the last term. So we reduce that last term, 256 to 250, and the next smaller term to 123. The nine piles then stand: 1, 2, 4, 8, 16, 32, 64, 123, 250. This arrangement may be slightly varied without reducing the final term. Thus: 1, 2, 4, 8, 16, 32, 63, 124, 250; 1, 2, 4, 8, 16, 32, 62, 125, 250 or 1, 2, 4, 8, 16, 31, 63, 125, 250.

Solution to "A Puzzle Within a Puzzle"

THE note is decoded to read: "I pay as many dollars for a dozen dozen cigars as I get cigars for three dozen dollars. What price a cigar?"

Let us call the price of a cigar X, and deduce from the statement the following equation:

144 X equals 36 divided by X, and the value of X proves to be one-half dollar.

If the price of a cigar were 25 cents, as many solvers submitted, then 144 cigars would cost 36 dollars, and 36 dollars would buy 144 cigars. But, the number of dollars (36) paid for 144 cigars does not equal the number of cigars (144) procured for 36 dollars.

Prize Winners in June Contest

First Prize of $10 is awarded to A. W. Brown, Apt. 303, 1870 Wyoming Ave., N. W., Washington, D. C.

Second Prize of $5 is awarded to A. J. Cipriani, 1808 St. Catharine W, Montreal, Que., Canada.

The ten prizes of $1 each are awarded to the following:

John Ellis, 138½ Lecky Ave., N. S., Pittsburgh, Pa.

Roger Degnan, 280 Caroline St., Derby, Conn.

H. Elliot Clancy, 8 Montclair Ave., North Quincy, Mass.

Geo. Wentworth Williams, Jr., 81 So. Kanawha St., Beckley, W. Va.

Chester A. Phelps, 916 So. Presa St., San Antonio, Texas.

Frank Schmulowitz, 53 East 7th St., New York City.

J. Gordon Wilson, 8616 Kentucky Ave., Detroit, Mich.

G. G. Williamson, Oxnard, Cal.

Robert J. Mercer, 604 West 112th St., New York City.

Cadet Marcellus Duffy, "I" Company, U. S. M. A., West Point, N. Y.

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▲ ▲ ▲

In this country, we are in the midst of an adult educational movement. Home study courses are being taken by about 1½ million people which is nearly twice the total number of students in our universities, colleges and professional schools. University home study courses are especially important in this movement because they offer careful guidance under experienced educators. ❧ Columbia courses have been prepared to meet the special requirements of study at home. They are sufficiently elastic to be adapted to the students' individual needs. Everyone who enrolls is personally taught by a member of the University teaching staff. ❧ In writing, mention subjects which interest you, even if they are not listed, as additions are made from time to time. ❧ Our Home Study Department offers also complete high school and college preparatory training through courses covering the equivalent of four years of high school study. We shall be glad to send our special high school bulletin upon request.

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DRAFTING
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ECONOMICS
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In order to make this list as complete as possible, SCIENCE AND INVENTION invites manufacturers to submit copies of their booklets or other literature. No obligation is involved. Simply address the materials to SCIENCE AND INVENTION, 381 Fourth Avenue, New York City, with a brief note authorizing inclusion of the booklets in future lists.

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2. All Windows and Doors Leak Like Sieves. Advantages of weather strip.

25. The Cost of Comfort. Handbook on economics of dwelling insulation, with full data.

61. Thermal Insulation of Buildings. Non-technical treatment of principles of insulation for homes. Five cents.

55. Just Between You and the Weather. Insulation for the home.

56. Insulation Sprayed on Process. Application of insulation by gun.

49. Celotex Cane Fibre Insulation. Uses of this type of insulation.

50. Year 'Round Comfort and Fuel Saving for Every Home. Advisability of complete insulation.

51. Flintkote Asphalt Emulsion and Plastics. Particularly with reference to refrigeration.

53. Flintkote Asphalt Emulsions for Water Proofing and Damp Proofing. Specifications for use of this product.

54. Zenitherm Defined. Exterior and interior uses of this product.

64. Increasing Home Enjoyment. The advantages of insulation in homes.

65. Roof Insulation and Prevention of Condensation. Importance of insulating roofs.

86. A Guide to Home Comfort That Pays Its Own Way. Greater comfort and economy in the home through insulation.

91. Inso Board for Plaster, Stucco Base and Sheathing. Self explanatory.

92. Inso Board Is Not An Added Expense. Folder illustrating practicability of Inso board.

93. Inso Board for Summer Cottages and Remodeling Purposes. Self explanatory.

94. Red Top Insulating Lath. Folder illustrating practical insulation.

95. Red Top Insulating Board. Comforts of insulation.

INCINERATORS

4. The Decent Way. This booklet discusses the advantages of disposing of garbage with a gas-burning incinerator.

ROOFING AND SHINGLES

16. Real Roofing. Booklet showing the advantages of a copper roof from an economical standpoint as well as that of beauty.

17. Rust-Proofed. Booklet setting forth the economical reasons for using brass and copper for such as roofs, gutters, drain pipes, plumbing fixtures, etc.

27. What Constitutes Roofing Quality? The facts about asphalt shingle and roofing products.

28. Color. Colored photographic samples of asbestos shingles.

73. Galvanized Iron for Roofs and Roof Drainage. Details and specifications.

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Gentlemen:
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FURNITURE

43. The Home Magnet. Billiard tables in the home.

SURFACE MATERIALS AND FINISHES

52. Flintkote Asphalt Emulsion Flooring Mastic. For flooring, floor patching, and resurfacing.

54. Zenitherm Defined. Exterior and interior uses of this product.

23. Wood Floors. Floors of beauty and use.

40. Oil Cloth, the Modern Cinderella. Varied uses in the modern home.

41. Wall Decorations in the Modern Manner. Sanitas—a modern wall covering.

42. Sanitas, Modern Wall Covering. How to use this product.

32. Beautiful Floors. Rubber flooring.

36. Enduring Beauty in Your Home Through Keramic Tiles. Self-explanatory.

62. A New Kind of Hardwood Floor. Information about a new and unusual flooring.

67. Portland Cement Stucco. Various surfaces of stucco and application to styles of architecture.

68. Recommended Practice for Building Watertight Basements with Concrete. Folder with information on making the basement watertight.

69. Beautiful Homes of Concrete Masonry. Complete plans of homes using concrete masonry.

70. Attractive Small Homes of Concrete Masonry. Plans and photographs for small homes and their interiors.

71. Concrete Improvements Around the Home. Self explanatory.

80. The Fifth Ingredient. Uses of surface hardener for concrete.

81. Colormix. Color hardener and waterproofer for concrete floors.

82. Cabot's Building Specialties. Data on stains for wood, wood preservatives, waterproofing, damp-proofing and insulating material.

83. Rooms of Happiness. Improving waste space through wood-fiber insulating board.

84. Swimming Pools. Styles and plans of swimming pools.

85. Tennis Courts for All-Year Sport. Plans and specifications for making.

HARDWARE

74. Brown & Sharpe Small Tools. Full line of small tools described.

75. Atkins Silver Steel Saws—Saw Sense. Saws and their uses.

76. Corbin Locks and Hardware for the Home. Locks, window and door hardware, etc.

77. The Corbin Concealed Casement Operator. Operator for window opening outward.

78. Screen Door Hardware. Door and window screens, both treated.

79. Helpful Information on Corbin Door Checks and Their Mechanism. Self explanatory.

87. Bartlett Products. Mechanics' snips and bench shears.

88. Yankee Tools. Various tools and uses.

89. Twelve-in-One Tool. Describing one tool and its twelve uses.

PLUMBING

12. The End of Rust Troubles. Advantages of brass pipe.

13. Brass Pipe and Health. Hygienic aspects of this product.

19. Water Services That Serve. Copper and brass pipes for water service.

BATHROOMS AND BATHROOM ACCESSORIES

57. Spartan Ceramics Portfolio. This illustrated portfolio demonstrates the beauty and practicability of tiles.

58. Architectural Handbook of Romany Tiles. Illustrated booklet demonstrating uses, plans, and designs of tiles.

59. Plumbing Fixtures for the Home. Illustrated pamphlet giving plans for bathrooms and necessary fixtures.

60. Homes of Comfort. Illustrated booklet showing plans and illustrations of bathrooms with complete material concerning fixtures for the modern bathroom.

39. Bathroom Individuality and Charm. Illustrated folder showing bathroom accessories in modern color.

38. Church Improved Sani-Black Seats. Illustrated booklet demonstrating an important accessory for the bathroom.

37. Bathroom Accessories, Medicine Cabinets, Mirrors, etc. Complete catalogue of these articles.

66. Planning the Small Bathroom. Facts about plumbing with a complete plan for a small bathroom.

WIRING AND LIGHTING

14. Wiring and Re-Wiring to Modernize the Home. Practicability of correct wiring.

15. Home Fixtures. The beauty of modern fixtures in brass.

LUMBER

21. You Can Make It. Pamphlet illustrating uses of odd pieces of lumber. Ten cents.

22. For Home Lovers. A booklet on home building giving plans and illustrations.

30. Money Saved for Builders. Red cypress wood for home building.

31. Specification Data for Structural Uses of Tidewater Cypress. Self explanatory.

24. Modern Home Interiors. Plans for building breakfast alcoves, kitchen cabinets, bookcases, etc.

34. Manual of Supercedar Products. Suggestions for installation of cedar closets and vaults.

44. Dubois Woven Wood Fence. Showing adaptation of this type of fence to interior uses.

45. Southern Pine—the Supreme Structural Wood of the World. Booklet of information on using Southern pine in the home.

46. Western Red Cedar. The Enduring Wood of the Ages. Interior and exterior uses of red cedar.

47. West Coast Hemlock, Its Qualities and Uses. Title self explanatory.

48. Sitka Spruce, a Quality Wood of High Service. Uses of wood named in home building.

HEATING AND VENTILATING

1. Ideal Heating. Heaters for homes and water.

5. Oil Heat Kills Furnace Slavery. Automatic oil burners for domestic heating.

6. Cold Corners Are Cozy Corners Now. Portable electric radiators and humidifiers for the home.

7. Ideal Gas Boilers. A.I.A. File No. 29f4. Data on domestic gas boilers.

3. The Modern Home Demands Hot Water Service. Automatic hot water heaters.

72. The Story of Gas. Story of gas and development to modern home appliances.

9. Donley Book of Successful Fireplaces. Illustrated from constructive angle.

35. The Wood-Framed Fireplace. Period mantels in wood.

63. Carrier Weathermaker. Demonstrating the importance of air conditioning systems in the home.

20. The Home Fires. A beautifully illustrated booklet on proper fireplace construction for houses and clubs.

96. Winter Comfort. The warm air heater fully discussed.

WINDOWS, SCREENS, DOORS

26. Crittall Metal Windows. Installations and description of windows of this type.

33. Sound-Proof Door. A.I.A. File 17a5. Doors that are sound-proof, odor-proof, weather-proof, air-tight.

11. What Good Is a Screen That Rusts? Bronze or copper screens.

90. Screens That Meet the Test. Illustrating the use of bronze screens.

HOME BUILDING MATERIALS

29. Beauty in Brick. Adaptability of brick to home beauty. Fifty cents.

10. The Donley Catalog. Coal chutes, package receivers, laundry chutes, etc.

18. A Real Home. Brass and copper for domestic building.

Summer Comfort

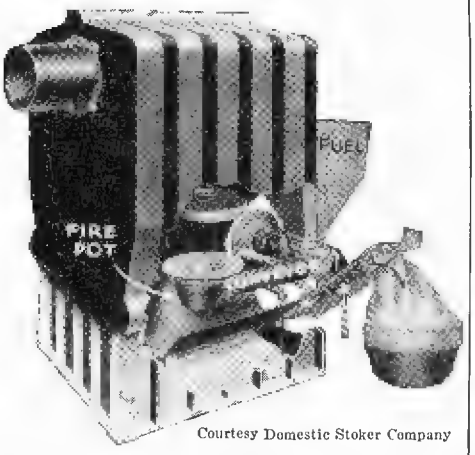
(*Continued from page* 405)

Next to electricity in cost is gas and this closely approaches it for excellence.

Gas has so many features in its favor that it is unfortunate its cost in most sections of the country is excessively high. It is brought into the house as needed, requires no storage space, and is constantly available in any quantity required by simply turning a valve. There are no ashes, and a properly adjusted gas burner is odorless, noiseless and produces no soot. In a properly prepared firebox gas is employed at high efficiency. The gas flame can be instantly regulated to increase or decrease the temperature of the house, whereas, with an ordinary coal fire, the flame responds to regulation slowly.

There are some students of house economics who prophesy that gas will be the heating fuel of the future. Many gas companies are making a definite effort in this direction by granting special low rates for gas used for heating.

A good oil burner, properly adjusted, has many of the advantages of the gas burner, especially as it also does away with handling fuel, eliminates ashes and dust and is readily amenable to automatic regulation and control by thermostats or otherwise. Oil burners are readily applied to existing coal burning heaters or boilers. They have gone through much improvement during the past few years. As a result many of those now on the market are dependable, quiet, economical and clean. Where automatic control is installed an oil burner system runs along without any attention on the part of the owner except a trip to the basement once or twice a week to check up on operation and to maintain the proper water level in steam boilers if they are used. On the other hand, in an oil burner installation the proper mixture of fuel and air is necessary for best results. A deficient air supply results in incomplete combustion with smoke and a soot formation, that tends to clog the flues and decrease efficiency. Likewise proper installation is of the greatest importance.



Courtesy Domestic Stoker Company

Here's how the mechanical stoker works. The coal from the hopper is fed into the bottom of the fire pot by a screw conveyor. It burns under mechanical draft, the ashes being forced off by fresh coal. The ashes are carried off into a receptacle.

Even in locations where oil is relatively more expensive than coal the increased convenience provided by an oil burner may more than compensate for the difference in fuel cost. Many householders are glad to pay a few dollars a month extra for fuel, if by so doing they completely eliminate the handling of coal and ashes and the

(*Continued on page* 455)

Burn Oil Newest Way

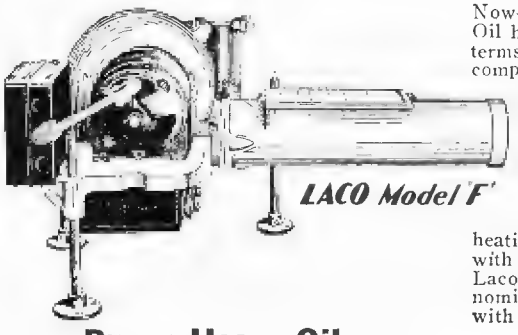
Complete Line of World's Lowest Priced

AUTOMATIC OIL BURNERS

The **LACO** MINERAL WICK OIL BURNER

Revolutionize Heating Costs

Oil Heat at Amazing Low Cost



LACO Model F

Now—never before an opportunity like this. Oil heat as cheap as coal . . . on the easiest terms ever offered—at the lowest price . . . complete with FULL AUTOMATIC CONTROL . . . room thermostat, and backed by the iron-clad guarantee of one of the largest and oldest manufacturers in the industry. Amazing new principle—the Laco Mineral Wick—U. S. Patented—solves the fuel waste problem, eliminating smoke, soot and grease, and smashing heating costs to a fraction. Don't put up with the old-time furnace drudgery longer. Laco costs so little, and operates so economically it just doesn't pay you to put up with coal.

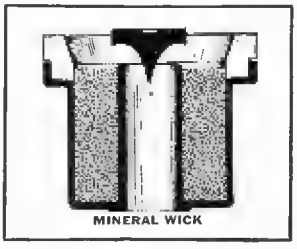
Burns Heavy Oils

Now—the latest, greatest addition to the famous Laco line. Laco Model F burns the cheap, heavy fuel oils and 24 West Coast Diesel Oil without waste. Specially designed combustion chamber does it—scientifically extracts every degree of heat from every drop of oil—meters it drop by drop as needed. Burns a slow, low pressure, lazy flame, in spiral direction—not a shooting flame that blows heat and oil out the chimney. Catches every drop of oil and burns it. Not an atom wasted. Gives clean, even heat, without smoke, soot, or carbon. Fully equipped with electric ignition, automatic controls—room thermostat, safety lock-out system, and stack switch. Rubber cushioned against vibration. Quiet. Several color designs. World's Lowest Priced Atomizing Power Burner.

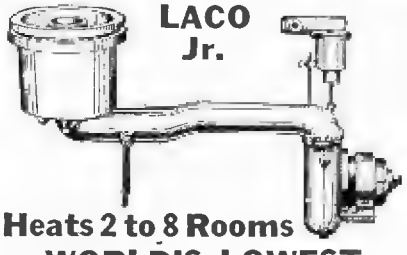
Burn Oil with Air

and Eliminate Fuel Waste

By means of the patented, indestructible Mineral Wick, the Laco oil-gas burner, burns oil with air. As the oil rises up through the mineral wick, it is converted into hydro-carbon gas—the most perfect means of creating cheap, intensive heat known to man, because all of it burns, and waste is eliminated. The hot gas—in contact with air—creates instant combustion, and burns in suspension. Safer than the ordinary kitchen range. Gives clean even heat without smoke, soot, or grease. FULL AUTOMATIC—Safety Controls—Room Thermostat. Quiet. No gas or electric ignition.



MINERAL WICK



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Heats 2 to 8 Rooms

WORLD'S LOWEST PRICED POWER BURNER

Fits instantly Arcolas, Heatrolas, Stoves, and small furnaces. Can be attached to water heater. Gives quick hot water for shaving, bathing, etc. Operates on as little as ½ pint cheap distillate an hour. A Mineral Wick Burner—safer than gas or coal. Amazing low price.

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Get into the fastest growing industry in America—with the fastest growing company in the business. Laco sales were in the millions last year. Dealers report as much as $50,000 profits. With or without capital. Oil heating experience not needed. Write us today for the most astounding offer you ever heard of, liberal discounts, and complete information.

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601 Union Street Griswold, Iowa U. S. A.

Quickly Installed Wherever Heat is Needed

No matter what kind of heating system you have—hot water, air, steam, or vapor, whether the tiniest home or the largest apartment or commercial building, whether for cook stoves, parlor furnaces, etc., there's an exact Laco Model for you. Instantly installed. So simple many users put in their own. You don't have to brick the fire bowl, or injure your present furnace in any way.

Easy Payments

Don't spend another winter without automatic oil heat. Install the Laco right now—on the easiest terms imaginable—at the lowest prices ever offered.

Special Offer

Write us today and tell us the kind of heating system you now have and the size of the home you want to heat. We'll tell you the exact Laco Model you want, and send you the **sensational Special Low Introductory Offer.**

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(Attach this coupon to your letter for Special Introductory Offer. Be sure to state type of heating system, size of home, and whether or not you want to be our Laco dealer in your community.)

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"I got a raise without asking for it"

"WHAT do you think! The boss called me in today and said I had made more progress in the past year than any man in the organization and that, beginning this week, my pay is raised $15!

"He said he had given my work particularly close attention since I enrolled for that International Correspondence Schools course. Said if the other fellows would take it and get as much benefit out of it as I did he would have the most efficient force in the country! You certainly had the right idea, Grace, when you persuaded me to enroll with the I. C. S."

• • •

Perhaps an I. C. S. course is just what you need to attract the attention of the boss and to get a raise without asking for it. Thousands of men have found in enrolment the beginning of successful careers. Are you willing to devote a few hours a week to pleasant study? If so, let us tell you more about the I. C. S.

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Without cost or obligation, please send me a copy of your booklet, "Who Wins and Why," and full particulars about the subject *before* which I have marked X:

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Do You Know Your Numbers?

A Cross-Word Puzzle by RICHARD H. TINGLEY, C.E.

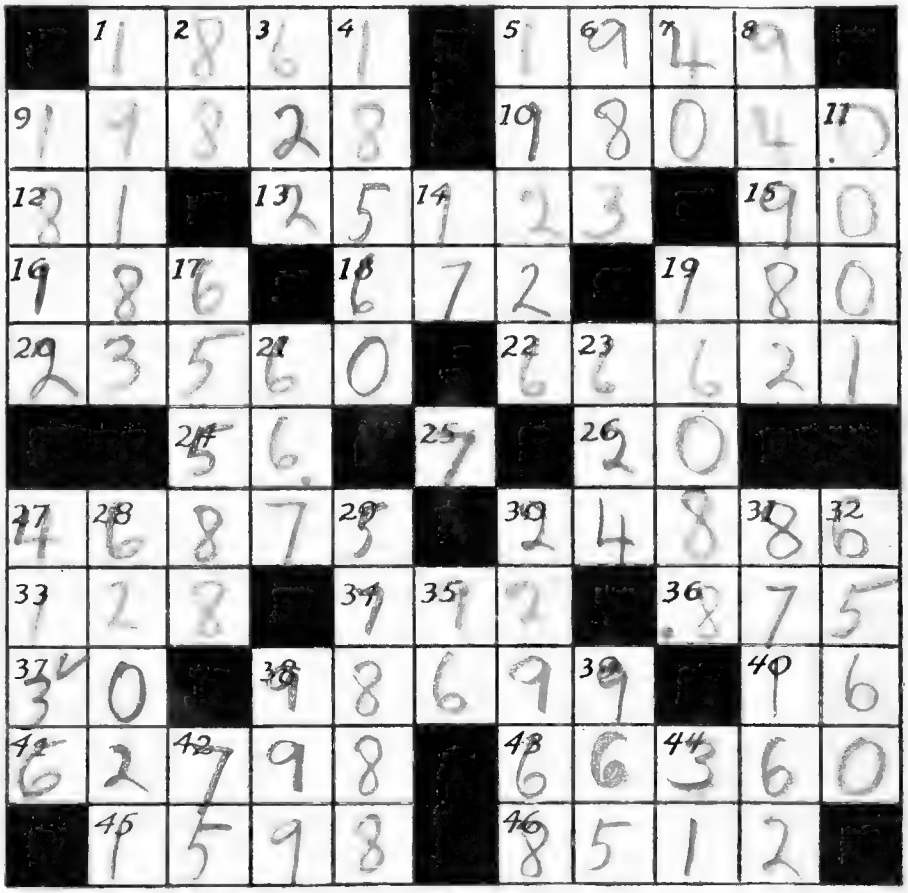
In this puzzle you have a chance to test your knowledge of chemistry, history and mathematics.

ACROSS

1. The year Fort Sumter was fired on by the Confederates.
5. The year when President Hoover will be 75 years old.
9. Convert 2478 gallons into pints and then add IV.
10. Multiply the year when Napoleon was crowned Emperor of the French (or rather crowned himself) by an X.
12. Three cubic yards in cubic feet.
13. Subtract 1877 from the cube of 30.
15. The number of degrees in a quadrant.
16. Thirty-one fathoms in feet.
18. Multiply these digits together 6, 7, 8, 2.
19. The number in minutes in three hours.
20. Subtract twenty thousand from the number of square feet in an acre.
22. Add 3261 to the number of inches in a mile.
24. Add 6½ to the number of feet in three perches.
25. The number of the deadly sins.
26. The difference between the boiling point of water by the Centigrade and the Reaumur thermometers.
46. Multiply together the digits 9, 9, 9, 9, and add the year it will be 21 years from now.

DOWN

1. Subtract 500 from the cube of 27.
2. The square root of 7744.
3. The year of the Hegira.
4. Twenty-nine square miles in terms of acres.
5. MMM multiplied by 3.742.
6. What decimal part of an hour is 59 minutes? Carry three places. Decimal in front.
7. The number of poles in an eighth of a mile.
8. Multiply 1583 by the number of minutes in a degree. Then add 2.
9. The date of our second war with England.
11. One ten-thousandth.
14. Add 5/10ths to a perch expressed in feet.
17. 5045.23 "baker's" dozens. Nearest whole number.
19. Multiply MDCLXXXVIII by X. Then subtract 792.
21. Five per cent simple interest on $20 for 8 months in cents.
23. The number of feet in 104 fathoms.



27. Express 15/32nds decimally.
30. To the number of inches in 100 rods, add 194 less than the number of feet in a mile.
33. The number of cubic feet in a cord of wood.
34. The number of inches in a link. Decimal after the first figure.
36. Express 56/64ths decimally.
37. The number of cents you sometimes look like (Slang).
38. The chemical symbol for lithium, times the abbreviation for a verb intransitive, times CCCXXII, plus CLXVII.
40. The number of avoirdupois ounces in a pound.
41. Multiply the fourth "teen" number by 3924 and 7/8ths.
43. The number of seconds in a degree multiplied by 18.43333. The nearest whole number.
45. CVI years after Columbus discovered America.
25. The number of the wonders of the world.
27. The number of pints in 517 gallons.
28. Multiply together the digits 9, 8, 7, 6, 5, 4, and then add 1541.
29. 67/100ths of the number of seconds in a day.
30. Add DLXVIII to the number of acres in XXXV square miles.
31. Subtract MXIV from the number of feet in 16.7 miles.
32. Subtract the number of rods in four furlongs from the number of pounds in three long tons.
35. The number of sheets of paper in four quires.
38. Nine hundred and thirty-one years ago.
39. Five gold francs in cents.
42. The yearly salary of the President of the United States expressed in thousands of dollars.
44. The number of presidents we have had in the United States.

(See solution on page 464)

FORECAST

By the Official Forecaster

NEXT MONTH we aim to cut loose with the **best contest** ever concocted by any publication in the business. . . . It's one of those contests in which you can work out your whole problem on paper, with the help of a few easily available references which we shall help you to get ourself. . . . The whole thing will cost each entrant a trifle of cerebral activity, the price of an envelope and paper, and a couple of stamps. . . . And the prizes! Wait until you see—you'll rush out for stamps and stationery **pronto.**

WHEN A GAS MAIN turns into a **gas mine** and blows up, right on Broadway, or rather under it, concentrated emergency work has to be done at the double-quick to clear the wreckage and restore the town to working order again. . . . An article on perhaps the most important phase of this big salvage and repair job is lined up for your early perusal in S. & I.

ANOTHER PIECE we're hopped up about considerable, reveals the inside story of the most remarkable adventure in **fruit culture** we've ever read. . . . Picture a fruit that can't mature unless at a certain point another species of the same fruit is placed in its vicinity, and an insect from this other fruit tries frantically and unsuccessfully to enter the first fruit with its eggs! The insect dies, the fruit ripens—this process has been utilized for more than a thousand years in the Near East. The complications that have arisen out of its utilization in America form the theme of the article we mention.

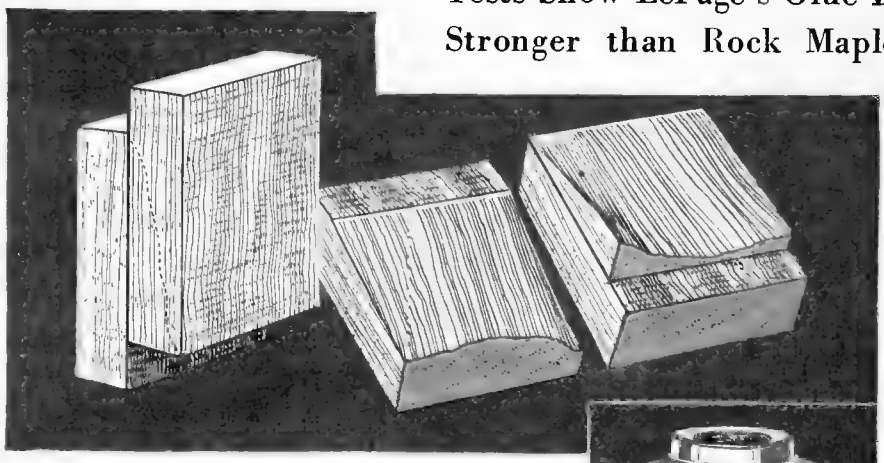
OTHER INTERESTING FEATURES include **Sky Jobs and Ground Jobs,** by Orville H. Kneen, author of **Everyman's Book of Flying,** a notice on which may be found in **The way I see it——,** present issue; **New Light on Old Masters,** which tells of the scientific examination of the pictures in the Louvre; articles on the **shark industry** and **miniature movie set making,** and a number of picture pages of decidedly out-of-the-ordinary type.

CHEMISTRY for the home lab is going to get a better play than ever before in S. & I. . . . We have started **a new contributor** of extraordinary ability on a group of chemistry articles which includes some of the most fascinating and up-to-the-minute experiments in the field. . . . We have a deal of **physics** and **constructor** stuff booked, too.

THE BASEMENT PLAN AWARDS will be covered by **two more articles,** in the October and November numbers respectively. . . . We confess to having been highly pleased by the ingenuity and the finished workmanship presented by the winning entries. Also by the genuinely artistic sense of appropriateness and design. The wide interest shown in the idea of basement utilization and the practical examples made available by the contest are two of the happiest results of the enterprise.

Would You Believe It!

Tests Show LePage's Glue Is Stronger than Rock Maple



Left: Shows two blocks of Rock Maple lePaged together.

Right: Shows Rock Maple ripped apart under strain of 3000 lbs. per square inch but joint made with LePage's still perfect!

NOT just one test, but many tests. Over and over we've tried to break LePage's joints in rock maple on the Olsen Shear Testing Machine. You know what tough stuff rock maple is. But it's the rock maple that *always* gives. What a test for LePage's strength that is!

Look at the illustration above, taken from actual photographs. It wasn't the LePage's joint that gave way. It was the fibers of the rock maple that were ripped apart under a pressure of 3000 pounds per square inch.

LePage's Glue (Liquid, Hard or Waterproof) stands pressure of 3000 lbs. per sq. in. Stronger than the fibers of the wood it joins. Every batch is tested.

Any cabinet maker will tell you your finished work is as good as the strength and permanency of its joints. Use LePage's and be assured of immense and lasting strength.

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Golf Pro's Bench
Manual Training Schools
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In House Under Construction
Everywhere!

You Can Make This Spanish Galleon Yourself

LePage's Job Plan No. 26 shows how. Price complete only 10 cents. Order direct. Send 10 cents in coin or stamps. Specify Job Plan No. 26. Address: LePage's Craft League, 767 Essex Ave., Gloucester, Mass.

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If you prefer to use a hard glue ask for LePage's Tested Hard Glue. Tested for uniform quality. No experimenting with each new lot to see how much water to add, or how long to cook.

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CONDUCTED BY JOSEPH H. KRAUS

In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain patent phases. Regular inquiries addressed to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are published here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail, a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

NOTE:—Before mailing your letter to this department, see to it that your name and address are upon the letter and envelope as well. Many letters are returned to us because either the name of the inquirer or his address is incorrectly given.

Eagle Airplane?

(1230) George Krisch, of St. Louis, Mo., submits a copy of a patent and a beautifully colored sketch of an airplane, which he calls "Vulture Americanus." He asks what we think of the invention.

A. Our aviation editor, Mr. Augustus Post, has remarked that while he does not see how your airplane could possibly be made to work, he certainly does regard it as being extremely patriotic. In this statement we concur, but a patriotic representation of an airplane never put any cash in the inventor's pocket. The practicability of the invention is the all-important consideration.

If an airplane were developed as you have indicated, and you could show by means of a practical demonstration that the plane would fly, there would be many who would rally to the standard that you so interestingly portray. Unfortunately, practically every ornithopter (flapping wing type of airplane) has met with extreme difficulty in its initial flight demonstration. Some

See him on high in peaceful Flight carrying the Stars and Stripes circling and ascending with the sunlight falling through his broad wings and tail. He will be a feature in the Landscape which will make it seem vaster and the clouds higher and the sky immeasurably farther away. He will be something more the sight of him and the sound of his Patriotic song will complete and intensify the affect of Nature's wildness and Majesty

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models work, but then there is a vast difference between the construction of a model and the flying product.

We regret we can do very little to aid you in putting your idea across. You will probaby have to finance this from your own standpoint.

Rope Fire Escape

(1231) Roy C. Hyde, Rowan, Iowa, has presented a safety fire escape for comment. The device consists of a rounded grip in which a speed control is found. This slides on a rope hooked to the window.

A. We would advise that we do not consider the idea either practical or new. It is very obvious that the pressure on the handle is absolutely necessary to curtail the speed of descent. What happens if a child holds on to a device of this nature? In the first place, one cannot expect a small child to grab the grip firmly. Consequently, due to the fact that she cannot exert very much pressure on the rope she would descend at greater rate of speed than would a man who can grasp the grip very tightly.

Incidentally, your device is only good for one descent. If two or three individuals were trapped in a burning building, one of them would be saved. The others would be left.

A Perpetual Motion Patent

(1232) John Jokisch, Detroit, Mich., says he is building a model of a perpetual motion machine. He claims he did not specify it was a perpetual motion machine (when he took out patents on the same) because the patent laws state that devices in this class are inoperative and none are obtainable. He, nevertheless, insists that his device falls within the perpetual motion class, because it is operated by gravity.

The Patent Department of the United States Government will grant a patent on a perpetual motion machine only when and if a working model of the same is presented. Inasmuch as your device was not patented as a perpetual motion machine, even though you claim perpetual motion for it, it is quite obvious that, first, you had a clever patent attorney, and second, that you never built a model. Any device operating by gravity or inertia without the addition of an outside source of power can be classed as a perpetual motion mechanism, and can be entered in our $5,000.00 contest.

It is a well-known fact that inventors have obtained patents on perpetual motion mechanisms which they call energy transmission systems, musical devices, toys, automobile wheels, leverage systems and the like. Patent attorneys generally insert a word or two regarding the addition of some source of power "should the same become necessary" or for the purpose of "starting the device." We should believe that the Patent Department at Washington would bar any mechanism that even smacks of perpetual motion, but perhaps the examiners do not attempt to look through the disguise. A change in the name of the patent, therefore, seems to be a convenient way of getting around patent office rules and regulations.

We would advise that we shall be very glad to see your machine in operation upon its completion. Having carefully gone over your specifications and drawings, we can see no way in which the same would operate without the constant addition of an external source of power other than gravity.

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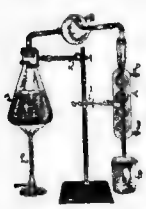

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Wings Around the World

(*Continued from page 394*)

miles were flown by all types of airplanes. This distance is equal to 5½ times the distance between the Earth and Mars, when in closest approach to each other, or equal to 733,000 flights across America. There are 9,678 licensed and identified aircraft, 11,499 licensed pilots, and 8,184 licensed mechanics, 1,583 airports completed and as many more projected. The network of air lines over this country serves 90,000,000 people and the industry represents an investment of over $500,000,000 and employment for more than 100,000 persons. Mail planes carried over 7,000,000 pounds of mail more than 13,000,000 miles. The decrease in the number of accidents is marked; 1,000,000 miles are flown for every fatal accident on regular transport lines and more than half the causes are human errors, structural failures representing only six percent, and the motor eighteen. This infant industry, hardly twenty years old, built last year aircraft and motors to the value of $98,000,000.

Globe Trotting by Plane

The large majority of aeronautical engineers and authorities seem agreed that the airship rather than the airplane will prove to be more economical and satisfactory for long-distance, heavy-cargo, air transport. It is even confidently predicted that in the present generation airships will provide the major means of travel for "globe trotters" and will supplement trains on land and steamers on the ocean, shortening the distance between nations and continents, following great circle routes, traversing polar wastes, desert wilds, steppes, pampas and jungles with equal ease. Each country will have a world airport; some will have more. The United States will have airports for transoceanic aircraft on the Atlantic and Pacific Coasts, in Alaska and the Philippines.

The first world airlines established will be between Europe and South and North America, followed closely by lines between England and India (already established for airplanes) and Canada. Later lines will run from San Francisco to Honolulu, Japan and Australia. Steamships are the slowest means of travel and the distances which they must cover in sea voyages are usually of such a length that aircraft—traveling at least four times as fast—will compete with them for the class of trade most affected by the elements of speed and comfort. Lincoln Ellsworth, the famous polar explorer, who accompanied the late Roald Amundsen on his famous polar flights, says that the Arctic holds a great commercial possibility for the future. As the mean average summer temperature prevailing over the Polar Sea is around the freezing point, and as there are no air pockets, it offers ideal flying conditions, and the Orient and Occident eventually will be linked by air communication via the North Pole.

The largest land planes yet designed are projected by Dr. William Whitney Christmas. They have a single cantilever wing with a span of 262 feet and a gross weight of 164,000 pounds, and carry 206 people. Their eight engines are of 1100 h.p. each. The cabin, in the wing itself, gives comfortable accommodation for the passengers. Igor Sikorsky, who has pioneered in the construction of large machines, confidently predicts planes of 100 tons' weight carrying 200 people, giving regular thirty-six hour transatlantic service. The form of the planes would be practically flying wings, and they would fly so high and attain such great speed that, with their tremendous driving power, storm and fog would not be a hazard. Pilots will fly by instrument, ultimately refueling and getting their bearings by radio beams from landing stations anchored at sea. Thus we see that, while the airplane must use fuel and power to support itself in the air, it can—if it has the ability to refuel at intervals of 500 miles—overcome the main obstacle to long-distance flights, and will be able to compete with airships on transoceanic routes.

Dr. Claude Dornier, constructor of the D O-X 169-passenger flying boat, is most enthusiastic about large craft and says that he sees no difficulty in the way of making a plane even three or four times the size of the D O-X, except the difficulty of adequate power plants. He has designs for a plane one-third larger than his present craft, which will fly with eighty or more tons, compared with the 52 of the D O-X. It will have 9,000 h.p. Mr. Frank Russell, president of the Curtiss Airplane and Motor Corporation, stated to me during the flight with Mr. Curtiss down the Hudson that the only limit to size of airplanes was the economic factor, namely how large a machine could be and still yield a good return on the capital invested.

Transoceanic flights have been successfully made with airships of the size of the Graf Zeppelin, but the results seem to indicate that in order to be commercially practical their size must be increased. Dr. Eckener expressed it when he said the Graf would be but a watch-charm compared with the future mammoth airships. The Goodyear Zeppelin Company at Akron is now assembling the first of a fleet of dirigibles of 6,500,000 cubic feet.

England has the R 100 and R 101—5,000,000 cubic-foot dirigibles—and others projected. The limit to size is put as high as 15,000,000 to 20,000,000 cubic feet gas capacity and from 300 to 500 tons' lift, carrying passenger lists comparable to those of the first-class ocean liners.

200 *Miles an Hour!*

The speed of these dirigibles will be at least four times that of the fastest steamers, leaving an ample margin to escape storm areas. Elaborate plans for ocean landing stations have been made and practical tests will be held during the coming year. The Armstrong Seadromes aim to give a worldwide service on the oceans by providing refueling stations on all ocean airways as well as weather information and emergency assistance. These floating structures will enable pay loads to be carried instead of costly gasoline and may make it possible for heavier-than-air craft to compete with lighter-than-air craft and capitalize their relatively higher speed of flight. With the reduction in fares for air travel to from five to seven cents per mile over the "bee-line" distance, with the utmost of comfort, luxury and personal attention, with speed, safety and reliability soon to be realized far above all other means of travel, as the air-mail has proved itself to be, the most fanciful dreams of the "globe trotter" are soon to come true and the span of the earth reduced from the 37 months of Magellan and the 21 days of the Graf Zeppelin, to ten, and perhaps even five days, when we can average 200 miles an hour.

The Missing Member of the Crash Board

(*Continued from page 397*)

no hysteria, no outcry, no demonstration of fear from anyone.

The passengers climbed stiffly out to examine in awestruck wonder the torn and crumpled metal wing and then to congratulate Stowe on keeping the plane from turning over, a common sequel to a ground loop.

Well, I thought, I've had my accident and I know how it feels. Everything happens so quickly that it means a sort of suspended animation, a freezing of muscles and nerves so that there is neither fright nor any other emotion, just a tense waiting for whatever the end may be. It was just a little accident, with a perfectly happy ending, but it served to demonstrate the human reaction to mishaps in a plane and that was what I had wanted to know.

With that settled I set out to get an answer to the question in my mind as to how much a pilot knows about his own accidents. Whenever there is a serious air accident, resulting fatally for the pilot, and whatever government or civil crash board investigates the wreck is unable definitely to determine the cause you will hear people say: "Oh, if only the pilot had been spared. If he had been able to sit as a member of that board he would be able to tell just how it happened and then perhaps similar accidents could be avoided in the future."

Your Guess or Mine?

So I went to Stowe, who was disconsolately viewing the wrecked wing, and asked him just what had happened. One of the passengers thought a pair of mules with which a Mexican had been plowing near the runway had trotted into the plane's path. Another thought the brake on the left wheel locked. Another thought a gust of wind had struck us.

"What was it?" I asked, and Stowe looked at me and shook his head.

"It wasn't any of those things," he said after some thought. "It was a combination of circumstances. You couldn't really pin the blame on any one thing."

And that's all the answer I could get; that's all the answer there was. Things like that happen so quickly that not even the man at the controls knows what it's all about. A couple of months later a plane Stowe was piloting crashed on a mountain side and he and everyone else in the plane were killed. At that time I heard the same old theory voiced: "If the pilot had only lived what valuable information he could give." But if Stowe had lived my bet is laid on the guess that he would tell the crash board that the wreck was caused by a combination of circumstances, and that's about the best any pilot can do.

That mishap in Clovis served to prove also that in air transport as in anything else, preparation is nine-tenths of success. For more than a year Colonel Lindbergh and scores of others had been working to make the line as near perfect as possible before starting service. Millions of dollars had been spent and about eighty-five per cent of the money had gone for ground work, airports, radio stations, airway beacons, everything to make flying safe and service efficient.

When we looped into that hangar we thought our flying was done for that day, but we were counting without the thoughtful preparation of Colonel Lindbergh and his associates. Hardly had our crippled

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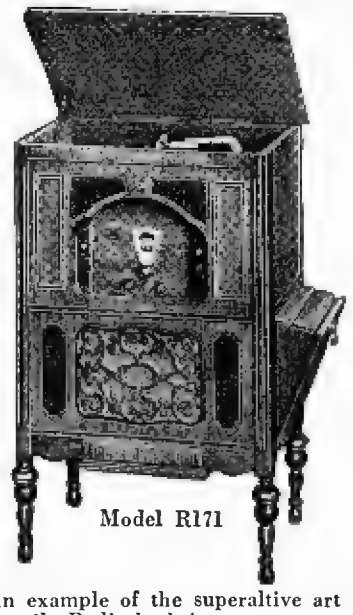

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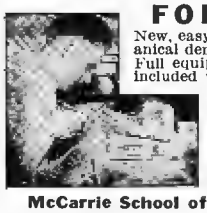

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plane come to a halt before mechanics were hauling a sister ship from the hangar and half an hour after our accident we were in the air in a substitute plane that got to Los Angeles that afternoon ahead of the one bearing Miss Earhart and which was piloted for the last stage of its journey by Colonel Lindbergh himself.

An interesting sidelight on the Clovis incident was that not one of the passengers evidenced the slightest hesitation about climbing right into another plane nor did they show any nervousness during the take-off when we roared down the runway and passed over the scene of our mishap before lifting easily into the air and heading west.

I believe the explanation of this was that Stowe so inspired his charges with confidence in his ability by his coolness in emergency that they were fully convinced that whatever may have been the cause of our accident it had nothing to do with his skill as a pilot. In fact the first thing they did when their damaged plane stopped its crazy course was to make unanimous request of the field operations manager that Stowe be informed of their confidence in him and their desire that he pilot them in the substitute plane.

Those passengers realized what everyone ought to see, that accidents are regrettable and everything should be done to avert them, but that they in no way stand as an indication that the particular mode of transportation they occur in should be done away with. There have always been accidents in all forms of transportation. I knew a man once who met his death in an ox cart when a wheel came off. But they can be, and always are, rapidly minimized.

How to Match the Hull, Motor and Propeller

(*Continued from page* 395)

out of the water, thus minimizing skin friction and causing the boat to skim the top of the water and attain very high speeds because of the practical elimination of all pressure. So far no design has been effected that has shown faster tendencies than the hydroplane. Some designers have tried two or more steps, and have even tried steps running from bow to stern, but all world's records are held by the conventional single step design.

A true screw propeller cannot operate efficiently unless the leading edge of the blades is continually moving forward and cutting into solid water, thrusting it to the rear. When the blades cannot reach solid water fast enough to maintain propulsion, and their rapid motion will not allow the water to back in around the hub of the propeller, we suddenly find our propeller transformed into an egg beater, whipping the water into a froth and creating a partial vacuum around the hub. This condition will continue until the motor is slowed down and the leading edges of the blades can function against solid water again. Which accounts for a motor racing while apparently under a full load.

It will be readily seen, therefore, that boats of Number 1 type should be powered by low-horsepower slow-turning motors. Likewise for slow-speed outfits a three-bladed propeller is desirable, as it increases blade area, giving more thrust and greater efficiency.

Boats of type Number 2 should be medium-powered; and while best results are usually obtained with the three-bladed propeller, a two-bladed one can be used with impunity when the motor is not turning over 3,000 r.p.m.

Number 3 boat, the pure racing type, carries extremely high speed and power. Here it is necessary to use two blades having very small area, as three blades turning over 3,000 r.p.m. will not allow water to reach any part of the blade except the extreme tip, and little or no thrust will be obtained.

Therefore bear in mind these simple rules. Heavy loads or slow speeds—slowly turning propeller, large blade area. Light loads at high speeds—fast turning propeller or small area and increase of pitch, pitch being the angle at which the blade exerts its thrust.

Remember this. The ideal boat for racing purposes, which, of course, means the fastest, operates with the least fuss on the water. Flying spray, a turbulent wake and the bow of the boat high in the air denote nothing but poor design, loss of power and excessive friction and pressure.

High pitch in a propeller is used to overcome small blade area. That is, while your slow-moving, high-area blade pushes a large volume of water to its immediate rear, the fast-moving small-area blade causes a large amount of water to slide or slip sidewise off the edge of the blades instead of to the rear. Therefore, the angle of attack is increased, throwing more water to the rear, and increasing the propelling powers.

A boat of the hydroplane type which merely skims the top of the water is of course a rough-riding craft in choppy water as it will jump from wave-top to wave-top with many resounding thumps and subsequent bruises to the driver.

In smooth water, it is perfection; and of course in boating, as in any other form of sport, comfort must be sacrificed to high speed. The slightly rounded or vee bottom are better sea boats and not apt to be as wet as the hydroplane. The Number 1 type boat is wet in rough water and rides badly, because of its flat bottom, and is very slow at all times.

In this article I have endeavored to impress upon the novice the importance of selecting a propeller that will develop proper efficiency for the three most common types of hull in practical use today. Freak hulls require more study and separate treatment, which we will be glad to provide in detail at the readers' request. Should you wish this service, follow directions in the box on this page. Next month we shall consider fuels, lubricants and the so-called "hopping up" of motors.

ARTICLES of this type can cover only in a general way a subject that in many cases calls for detailed treatment. If Mr. Dykes can help you solve any problem regarding hulls, motors, parts, fuels, racing rules, the formation of clubs, or the managing of regattas, let him know. He'll be glad to give you all the information at his command. Write on one side of the paper and enclose a stamped envelope for his reply.

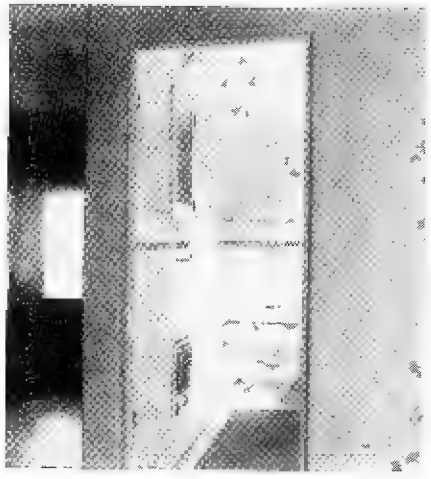
Be brief and specific. Questions likely to interest many outboarders will be answered in these columns. Otherwise your problem will be treated in a personal letter from Mr. Dykes or from some other authority on the subject involved.

Summer Comfort

(*Continued from page 447*)

other attentions required day and night by the average coal-burning system. In addition the freedom from soot and smoke makes the house far easier to keep clean and results in less frequent necessity for redecorating. The cleanliness also permits the utilization of basement space for play rooms or other purposes, giving the equivalent of an extra room or two for the house.

The features of automatic maintenance of uniform temperatures and automatic operation are usually associated with oil burners in the public mind, but have not been mentioned in that connection here, because they are not limited to oil burners in their application. They are just as applicable to gas and have been used in conjunction with coal heaters for years, although only to a slight extent in homes. Now, however, there is a mechanical stoker for homes on the market which, with mechanical regulation, makes coal-burning automatic to the extent that the furnace requires attention only once a day in the most severe weather and less often in moderate weather. This particular system is made for installation in the firebox of any coal heater. It has a firepot of its own and means for mechanically feeding coal to this firepot and for carrying away the ashes to a closed container. The firepot is relatively small and operates under mechanical draft, employing the cheapest sizes of anthracite coal—buckwheat and rice. Because of the mechanical draft the fire responds quickly to regulation and is, therefore, readily adaptable to automatic control. In cost of operation it is in most cases cheaper than oil or gas, and in some no more expensive than a heater burning the larger, more common sizes of coal. Yet it eliminates most of the drudgery of coal burning and provides a degree of convenience approaching that of oil or gas.



Courtesy Edison Appliance Company

A built-in electric heater in the bathroom is out of the way and surely valuable in cool weather, particularly early in the morning.

Automatic regulation to maintain uniform temperatures is a feature well worth consideration. There are various kinds of automatic regulators; mostly of the thermostat type. If used with a heating system that responds rapidly to regulation, temperatures are maintained constant within a range of a few degrees of a predetermined point. With an ordinary coal fire, the response is more sluggish, but even then the temperatures are maintained uniform. Then there are clock-type thermostats which will maintain the temperature at a given level during the day and a lower level at night, raising the temperature again at a predetermined hour in the morning so that the house will be warm when the family rises. Automatic fuel supply, of course, provides the best results under thermostat control.

Probably the most common type of thermostat control in homes is that employing a single thermostat, located in the living room or other central point. The drawback to this system is, that in regulating the fire according to living room temperatures, some other rooms may be too cold or too hot. Nevertheless its advantages are sufficient to make it popular. The ideal system is one in which a thermostat is provided in each room to control the individual radiators.

Much attention is now being given to concealed radiators. These may either be regular radiators behind radiator covers of wood or metal, or they may be the compact, fin-type radiators. The latter offer attractive possibilities for new or even for old houses, because they are so much smaller than cast iron radiators, that they can be built into niches in the walls or may be completely concealed within the walls behind metal grilles, or fitted under window seats. In addition to their smaller size, these radiators have the advantage that they heat up almost instantly, whereas the heavy mass of a cast iron radiator is less quick in its response to heat variation. When set behind a grille in the wall, the radiator can be controlled by means of a damper operating behind the grille.

In addition to the regular heating equipment the modern home usually provides for auxiliary devices to take the edge off the cool days in the late spring or early autumn when it is not worth while to start the furnace. A fireplace in the living room—and even in one or two other rooms—serves this purpose. An article on fireplaces will appear in the October issue.

Another auxiliary is one to provide comfort for the bathroom on a chilly morning. Electric heaters are coming into favor for this use, first the portable type and now the built-in type. These are small units which are set into the wall with their grille or screen faces flush with the tile surface. In most localities electric heaters are rather expensive to operate except in places where the rate for electricity is low. They are used only for short periods and are so convenient when needed, that the operating cost is considered well justified.

Above all, in laying plans for a new heating system or for improvements in the old, don't overlook any source of information. Study and examine the different types of systems and equipment and the available accessories for automatic regulation and control. A good, reliable heating system is a constant source of satisfaction. If it be one that runs itself, so much the better. Don't stint the cost too much and remember that any consideration of economy involves not only the question of fuel cost, but also other operating considerations whether or not they may be expressed in dollars and cents. Perhaps radical changes in the present system are not needed. Sometimes, for instance, the substitution of vacuum valves in place of the usual airvents on steam radiators will bring about decided improvements in an otherwise mediocre steam installation—and at a relatively low cost.

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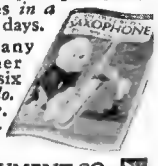

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There's Mystery Still

(*Continued from page* 403)

and caused no trouble to the travelers. These strange facts were learned about the war-like marauders of the desert who are originally from the villayet of Tripoli: In the first place, it is man the brute who by all laws of the country has to obey the women. Descent is traced through the mother; the woman shows her proud face to all the world, while mere man has to go veiled. In fact, in the presence of women of noble birth, the men must cover their faces and heads altogether.

Bullied and harassed by his womenfolk, the Tuareg has no liberty at all. All the domestic goods like tents, camels and clothes are the women's property. The stick he carries and the great wooden box into which he puts what his wife suffers him to have are all the man possesses and all he retains if for some reason his wife chooses to divorce him.

Even when a man goes out after sunset he isn't allowed to be alone. A negro servant is sent by his wife to dog his every step, and woe be to him if he forgets himself or comes home even a little bit late! He will find the door closed and must count himself lucky if he is not forced to find a bed out under the desert stars.

The young Tuareg man, who, in spite of all this tribulation wants to marry, must pay a heavy sum for the bride, so that usually he is obliged to look for other than legitimate means to gain his purchase price. Rearing camels or carrying goods for the Arab trader won't suffice, so the youth is forced to take part in one of the annual rhazzias, or outlaw raids where speed of attack and getaway is the sole code of morals.

The ladies decide when the strategic moment has come, whereupon the men sally forth against some luckless caravan or to the rich highlands of Tibesti. These fierce raids have destroyed many a fertile oasis, and certainly have accelerated the final disappearance of trans-Saharan trade.

Bird or Hunter?

Probably the strangest sight witnessed by the explorers was along the Niger, southeast of Burem when they came upon a native hunter disguised as a bird. "From a piece of wood he had carved a bird's head and neck, feathered it, and supplied eyes and an open beak," says Colonel Haardt.

"Moving slowly and stopping at times to peck at the ground or to examine his surroundings, just as a real bird might have done, this fellow was able to approach close enough to birds and hares to kill them with a stick."

At Tessawa, in the southern Sahara, 3,000 of Sultan Barmou's Hausa riders escorted the motorists into the town amid the din of tom-toms and trumpets. The Sultan is a modern Solomon, living in great luxury, and is one of the few men now living with a hundred wives. He was very cordial, permitting the expedition's photographer to visit his harem and take snapshots of his extensive household.

A somewhat less important native potentate who extended considerable hospitality to the party was the Chief of the Manbetu tribe in the northeastern part of the Belgian Congo. His wives number only 20, and they spend all their time cooking for their spouse or making themselves attractive for him. The men of the tribe are valiant warriors.

Beyond Lake Chad were found the "ugliest beauties in the world," members of the strange Mazza tribe which mutilates the lips of its women by piercing holes in them and inserting great wooden discs. The practice is also common in Mogorom. All the front teeth must be pulled to make room for these monstrous wooden adornments, and no female is considered really attractive without them. Some are as big as American dinner plates and the proper procedure of inserting them has become quite an art. When a girl is very young, perhaps 10 years old, the outer skin of both her lips is slit carefully and light metal discs inserted. Some months later wooden ones are substituted and larger ones put in according to the growth of the skin around them. In other sections of Africa long wooden plugs are placed in holes that are cut through a woman's nostrils and neck.

Towards the Congo the expedition turned its major attention to obtaining zoological specimens. They made a side trip from Yalinga to the Am Dafok swamp, jungle haunt of antelope, lions and elephants. Returning to Yalinga, they came upon a herd of hippopottami, and a halt was made to photograph and study them.

Near here a unique native way of catching elephants was witnessed. When a large number of these great jungle beasts was located by scouts, the natives cut a great circular path around the place where the beasts were foraging. Once the elephants entered therein, a scout gave the signal and the natives set fire to the surrounding grass until a terrible wall of flame hemmed in the beasts to the extent that, bewildered and frightened, they fell easy prey to the native spears.

Other colorful sights were some of the weird native dances. One of these, usually a distinctly male affair, involved rhythmic movements made by natives who carry plaited leather whips and paint their bodies with a paste made of bark, clay and ashes.

Another type of native dance, in which both men and women participate, is not unlike a sort of primitive country dance. To the beat of tom-toms the men line up on one side and the women on the other, everyone cavorting to the dull strains of the balafo, somewhat like our xylophone, made of wooden strips stretched above gourds and hit with large hammers.

In the Belgian Congo the explorers pierced the Equatorial Forest, where they came upon tribes practising a primitive "wireless" communication of surprising ingenuity. It is effected by drum-like instruments called gougoudous, made of wood, hollowed out on the early "loud speaker" principle, and struck with hammers encased in rubber. Various sounds are made according to the place and strength of the strokes.

Explains Colonel Haardt: "This sending station is placed in the middle of the village, just in front of the Chief's hut. When a message is to be sent, then the native operator strikes it off and the sounds can be heard six miles away.

"We rather doubted the efficiency of this strange telegraph until we were forced to believe by a personal experience. When passing through a certain village we asked its chief for four chickens to be brought to us a short distance ahead on the road we were to follow. As the gougoudou player struck the message off on his instrument, we drove rapidly away, so that the chief could not cheat on us by sending runners on ahead. Three miles beyond the village a native stood waiting by the roadside with the four chickens we had asked for. We were convinced."

The House That Ghosts Built

(*Continued from page 396*)

wealth and the determination she kept carpenters constantly busy for 38 years. During that length of time the sound of saw and hammer never ceased, and gradually through constant building, tearing down, and rebuilding, there was evolved a structure which is probably the world's strangest house. More than a million dollars was expended in following the suggestions of the spirits as given to her through her favorite medium.

In this mystery house there are 144 rooms, no twelve of which are on the same level; and they are connected by miles of winding, bewildering corridors, to negotiate which the services of an expert guide, who himself must follow arrows painted on the floor, are required by the visitors who come to behold this monument to a woman's desire to cheat death.

During Mrs. Winchester's life, no one was allowed within the structure except workmen in her employ. No one was allowed in the finished rooms to break the owner's seclusion. Maids in her employ cared for only a few rooms each. Only Mrs. Winchester and her twelve spirit-friends lived in the whole house.

Blank Walls, Trap-Doors and "Goofy Steps"

One of Mrs. Winchester's most intimate associates, her housekeeper, who had been in the employ of the family for 18 years, returned after her mistress had died and persuaded one of the guides to show her through the mystery house. She had never been permitted that liberty during the lifetime of her employer.

The house has bathrooms with screened doors, entrances leading to blank walls, closet doors without closets, trap-doors beneath which no aperture appears, weird "goofy" steps with 2½-inch treads, balconies overhanging stairs having neither purpose nor accessibility.

There are also a multitude of costly furnishings—gorgeous windows for which Tiffany has offered $5,000 apiece, elaborate gold-plate and silver fixtures, ornate wood-carved ceilings and walls. The whole house is a thing of contrasts running the gamut from the richly luxurious to the grotesque.

An earthquake injured some of the plaster and the owner never ordered it replaced. She believed that the earthquake heralded the end of the world. After many years of intensive building, apparently without purpose but actually motivated by a desire to defeat death, Mrs. Winchester died at the age of 85. Neither her money, nor her spirit friends, nor her faithful adherence to her program was able to ward off the grim reaper.

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Shears of Flame

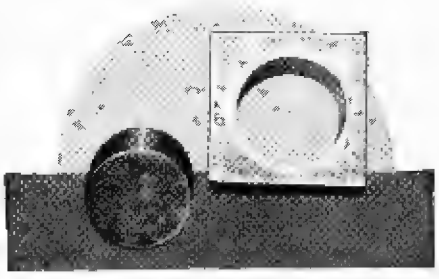
(*Continued from page* 401)

instances the cost of producing a given form by this method has been only a third of the amount involved when other shaping processes are used.

One large-scale manufacturer is fabricating all his jigs and fixtures of steel shapes cut by the automatic oxy-acetylene flame.

The automatic shape-cutting machine is of rugged construction. It has two movements, and is constructed so that a pull of a few ounces carries it along the cutting line. The templets which direct its course are made of aluminum strips mounted on a base of sheet iron. Once started, it follows the course laid out on the templet to the conclusion of the cut. A single templet base may contain directive patterns for several complete parts, making it possible to cut a number of shapes in succession, without changing the templet, from a single sheet of steel. Because of the accuracy of the method, any number of exact duplicates of the same part may be cut, facilitating quantity production of machines or forms of the same type.

A forming press or power shear manufactured of cut steel shapes has a definite advantage over one in which castings form a part of the structure. When operated beyond its capacity and severely strained, a machine fabricated of steel plate will resume its normal alignment as soon as the stress is removed. With a machine of the other type, permanent misalignment or breakage may result.



A metal disc and the piece of steel from which it was cut showing perfection of this system.

One company using the shape cutting method of manufacture calculates that, to maintain its schedules with some other process, it would require a plant three times the size of the present one. Moreover, with the automatic shape-cutting method, it can fabricate a machine and have it ready for delivery in about 48 hours.

A recent application of the automatic process is the production of ornamental iron work. Intricate patterns can be cut quite as easily as simpler forms.

Can You Tell a Mushroom?

(*Continued from page* 423)

Northern Siberia used this fungus in the preparation of an intoxicating drink, and suffers no poisonous effects.

The most dangerous of all fungi is the death cup (*Amanita phalloides*). The most certain method of distinguishing it from the edible mushroom is to note the color of the lamellæ or radiating plates on the undersurface of the umbrella. In the poisonous death cup they are always white. In the young mushroom they have a rose color and in older ones a dark brown. In addition the lower part of the stalk of the death cup is swollen into a sphere just above the ground, and this is never the case with the mushroom.

The effect of the poison in the poison cup is quite well known, but the substance which causes this is not so well known. It is thought to be an albumenoid substance or at least a product which resembles it closely and which is known as phallin. The effects of the poison make themselves felt six or eight hours after the fungus has been eaten. The violent stomach aches begin to make their appearance, together with diarrhea and vomiting, which is followed with delirium and cramps. About 75% of the cases end with death. But if the organism has withstood the attack of the poison for three or four days, recovery begins, and after this the majority of patients will recover completely.

The poison of some fungi is loosely bound and may be removed. This is the case with the European *Hevella esculenta*, which, although poisonous, is considered not only edible, but a delicacy. It contains a violent acid which affects the blood. But since this poison is soluble in water, the poison is removed by washing the fungus in water.

As far as we know, almost all poisons from fungi can be removed by soaking them in a large quantity of vinegar and salt solution for a long period. Then the fungi must be boiled in clean water and the water thrown away. Treated in this way, many fungi which we consider poisonous are eaten in Russia.

Trained Eye Only Real Test

Self-medication when one is poisoned by fungi is useless. Call a doctor at once. In the meantime take a carthartic in spite of the fact that diarrhoea may be present, and also tannic acid or a tannin. Substances that induce vomiting may also be given. Never give vinegar. The vinegar serves only to dissolve any remaining poison that may be present, washing it into the digestive tract where it will do the greatest harm.

There is no particular test which will tell whether a fungus is poisonous or edible. All the methods which have been employed from time to time are absolutely useless. The discoloration of a silver spoon shows only that the fungi have begun to decompose and are unfit for food. On the other hand the most powerful of the poisonous fresh fungi will not discolor a spoon. An onion boiled with the fungi shows nothing at all, while the discoloration of a cut on the stem is very doubtful. Even the holes eaten by snails or worms give no indication of the character of a fungus. The same is true of the color of the sap, the color or markings of the fungus or the color change that takes place on storing. The odor or taste of a fresh fungus is no criterion, for the most dangerous of the *Amanita* forms have no odor, while the most dangerous of our native types have a particularly good odor and taste.

There is only one certain way of telling a good mushroom from a bad fungus and this consists of knowing exactly what one is looking for. Of 500 kinds of fungi found in the vicinity of New York only a few are non-edible or poisonous, and these few every one who looks for mushrooms should know by sight. Among the few that are not edible, the most poisonous is the death cup and this is the one that proves almost invariably fatal to any who eat it. This means that only mushrooms known to be absolutely good should be collected.

Mechanical Live Stock

(*Continued from page* 399)

pelt. Concealed phonographs with synchronized records and built-in amplifiers furnish the chatter, which consists mainly of advice on sheep hygiene.

Another talking live stock company features a mechanical sow and a couple of her youngsters. One side of the old one is cut away and the interior illuminated to illustrate her motherly lecture on swine health. As she lectures, the young pigs begin to squeal from hidden valves through which compressed air is released. At last they swell up (by means of bladders gradually inflated) and explode. As they fall to the ground, the sow continues to argue vigorously on the desirability of sanitary surroundings for pigs. The sow in the act is dressed in a lifelike coat of black velour.

A genuine masterpiece is the mechanical man who milks a mechanical cow. The milker is made on a wood and wire frame and is dressed in a modern dairyman's white suit. His head is modelled of plaster and rubber, and real character has been built into his features. His arms are hinged at the elbows. His hands are attached to the teats of the cow. A motor inside the cow bobs the teats up and down, and the effect is a lifelike imitation of the milking process. At the limit of the down movement, a special valve squirts a stream of milk into a bucket.

The milk is an oily white emulsion which foams like the real article. It is this attention to detail that makes Uncle Sam's shows so fascinating. Stored in a tank behind the cow, who is clothed in natural cowhide, the milk is automatically returned to the reservoir by a rotary pump. The action therefore can go on indefinitely.

One mechanical act of the miniature variety shows the importance of blooded bulls in the improvement of dairy herds. Mounted on endless chains, a succession of champions climbs a hill, member after member of the parade disappearing until only the grand champion remains.

Another act shows the advantage of co-operation in dairying. Four manikins, one by one, lift milk cans upon a small platform. Nothing happens. But the next turn of the table on which the four are mounted makes them deposit their cans in unison, and when this takes place a bell rings loudly. The whole thing is operated by a cleverly arranged system of cams.

A rival of the oratorical sheep and swine is a cow who by means of cutaways and phonographic equipment describes the milk-making process. She is made of wall board and white pine, and is so realistically contrived that any dairyman feels tempted to try milking her.

An instructive forestry exhibit comprises models of virgin and cutover country in cross-section. Periodically a rain storm occurs. The organic matter in the virgin forest soil absorbs the water, while in the cutover land the surface rejects the downpour and the stream rushes down the hillside to form a dangerous flood.

An international exposition at London and the fourth world's poultry congress are two bookings for Uncle Sam's mechanical live stock shows this year. The World's Fair at Chicago in 1933 will be the biggest test of the show factory's ingenuity in decades. For that exposition a special scientific circus is being planned which will eclipse anything the incubator has done. Rumor says that it will combine Niagara, Mt. Vesuvius, and Old Faithful in a single marvelous spectacle. But that is a story for future recital.

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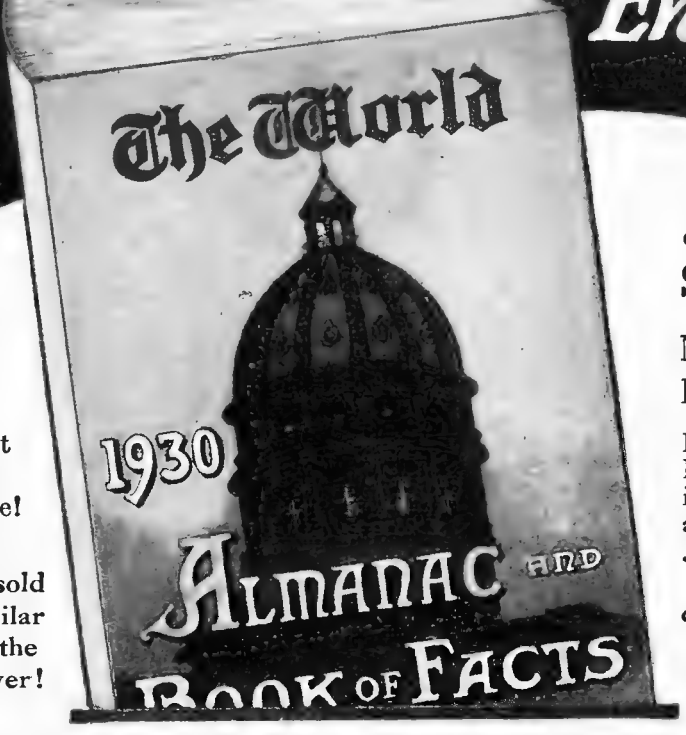

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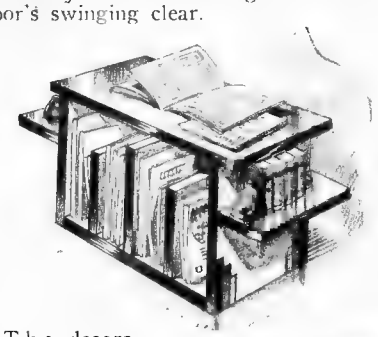
Modernistic Furniture

(*Continued from page* 441)

staying closed without the need of a lock or catch, and loose enough to allow the door's swinging clear.



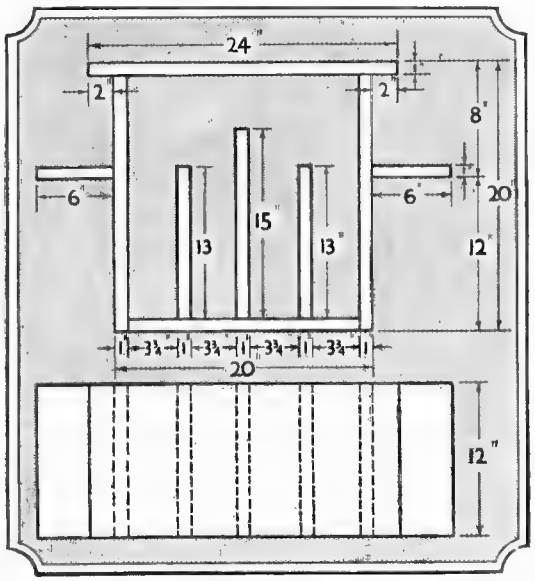
The decoration strips are now cut to proper size. These can best be obtained by using regulation wall lath. Plane the lath down to ⅛" in thickness and 1" in width. They should be made in fours, measuring 5" long, 7" long and 9" long. Place six on each side, as shown, holding them with glue. Nails are not necessary for these. A door-knob is then added.

Remove all excess glue, when thoroughly dry, and finish smooth with sandpaper. All nails should be sunk with a nail set. Nail holes, blemishes, and joints should be filled with plastic wood.

The stand is now ready to be finished. A first-class lacquer is recommended for this work, as it dries quickly, and is easily handled. Lacquer will also hide, as well as seal, all traces of joints. Three coats should be applied. Thirty minutes between coats is sufficient time to allow for drying.

Color is a matter of personal taste. Two tone color combinations work out very well, especially with the modernistic design, and if no set color scheme is used in the room in which the piece is to be placed, the writer recommends two tone combinations.

Magazine Rack



The trim magazine rack pictured above can be made by following this constructional diagram.

Here is possibly the most simple and useful article of furniture found in the correct home today. A piece of yellow pine 1"×12"×12' long is all that is required. Cut this piece into the nine following lengths:

1–24" long for the top.
1–18" long for the bottom.
2–19" long for the sides.
2–6" long for the shelves.
2–13" long for the short partitions.
1–15" long for the high partition.

These nine pieces are now sanded smooth, taking care that all edges are perfectly square. In assembling the rack use 1½" brads and hot glue.

To Handle Small Stove Pipe

SMALL stove pipe is hard to handle and disconnect when being taken down for cleaning. If the pipe joints are a trifle old it is a poor practice of course to work them too far back and forth at a joint, as it tends to unduly enlarge one portion and to compress the other out of round, shortening the two lengths when put solidly together again. Work on them with only a slight sideways motion, exerting if possible a direct outward pull. Getting a good hold on the pipe is not so easy. Take an old tire inner tube and cut off two pieces about two feet long, slitting them open, making two fairly large rubber sheets. Wrap one about the joint you straddle, and the other about the joint you pull and grip on. The thin rubber sticks to the surface of the pipe and gives you an excellent grip on it, and you can get a very strong pull with the spread and open hand, lessening the danger of crushing the pipe.—*Frank W. Bentley, Jr.*

Lacquer Varnish for Metal

TO make alcoholic shellac lacquers adhere more completely to metal surfaces, one part of boracic acid should be added to every 200 parts of varnish. This composition will adhere so firmly and become so completely glazed, as to be removed only with difficulty. Care should be taken not to add too much of the boracic acid, or it will injure the gloss.

Zinc Removes Soot

A PIECE of zinc a few inches square thrown on the red-hot coals in the furnace will effectively clean out stove pipes. The vapor carries off the soot. (*Radio "B" batteries broken up are good for this purpose.—Ed.*)

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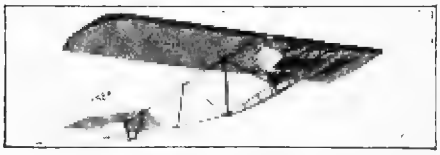

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Build a Bearcat Short-Wave Receiver

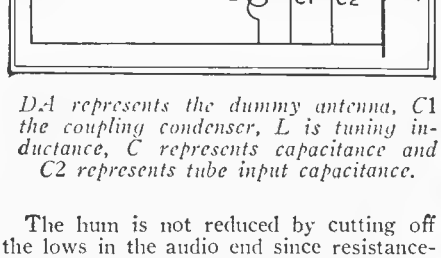
(*Continued from page* 409)

radio-frequency circuits. To make this shielding effective, unusually complete circuit isolation from the power supply unit has been resorted to, as can be seen in the schematic wiring diagram.

After careful experiments with both the –27 and –24 type detectors in this receiver the –27 type was adopted. Experiments with the –24 type detector in regenerative circuits were started over a year ago when the preliminary work on the 735 "Round the World Six" was done, and indicate that the tubes are not uniform in the requirements for a good regenerative detector. Because of their erratic performance they were discarded in favor of the –27 type detector and the slight loss in output is more than compensated for in the audio end.

In addition to the other causes of hum which are now generally recognized it was found that the magnetron effect was important in causing a "fringe" hum as the detector tube went into oscillation. This modulation of the electron stream by the magnetic field from the power transformer was more serious in the –24 than in the –27 type tube and added weight to the the decision to use the latter.

Careful isolation of the oscillator circuits, including the use of a common ground and filtration of the power supply, have resulted in a hum, which is low enough to permit the 'phones to be operated in the speaker output terminals. This filtering problem was made more acute by the determination to filter enough current to supply a real power tube, not merely an interstage voltage amplifier tube.



DA represents the dummy antenna, C1 the coupling condenser, L is tuning inductance, C represents capacitance and C2 represents tube input capacitance.

The hum is not reduced by cutting off the lows in the audio end since resistance-coupling and a –24 first audio tube are used. The –45 output tube insures adequate output for speaker operation where this is desired.

Summarizing, the design includes the features which are recognized to be important in a short-wave receiver, namely, high gain in the radio-frequency end, which can be secured only by complete circuit isolation; a stable, uniform regenerative detector with a minimum fringe and modulation hum; a high gain audio end with a characteristic which makes good fidelity possible and an output tube which will handle adequate, undistorted output for a speaker. To all of these must be added simplicity of operation and the ability to secure the extremely close tuning that is necessary for 'phone stations and the ability to spread a small band such as one of the "ham" bands over 100 to 180 degrees of a tuning control.

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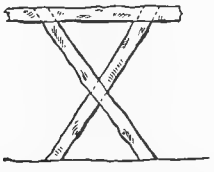
Beautify Your Garden

(*Continued from page* 426)

desirable, as when the chain holds a flower basket, other sorts of wood could be used.

For rustic fences, seats and summer houses, the tree branches used for the uprights should be about three inches in diameter and tolerably straight. For very light fencing-work posts may be driven in. The parts buried must be preserved in some way from rotting. In clay soil posts rot slowly, while in sandy and alternately wet and dry soil they rot comparatively quickly. Thus, packing clay round a post bottom is a superior way of preserving it to either tarring, creosoting or charring it. One further point with regard to preserving the wood: take care which way you place your rustic posts. Moisture has a tendency to pass along a piece of wood in the same way as it does when the tree is growing. So, that rain shall not quickly rot a post, place it in the position in which it grew.

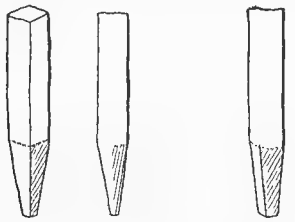
The horizontal rails of a rustic fence may be fairly regular. They must not be merely nailed to the uprights but mortised and tenoned into them, or a halfing joint used. The wood is round and work secured with only nails is very weak in reality and looks weaker. We show the sort of joints to be used and the modifications which will be necessary so that the roundness shall not make the joints ugly. For instance, the shoulders of the tenons must be hollow as illustrated and not flat. This is quickly effected with a gouge.



GARDEN EDGING

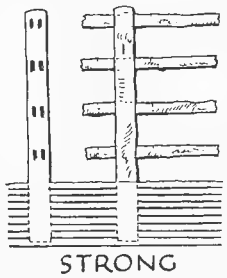
The simplest rustic fence is constructed with half-round palings nailed on to the horizontals. Another way of fencing is a sort of strong hurdling, which is suitable for fencing the outskirts of a large garden. The posts and horizontals are of round sections and the tenons are a fairly close fit. Often, however, they are shaped with the axe only. It is worthwhile here to note the procedure when a new post has to be put in a fence of this sort. It is hardly likely that the stump of a garden fence post will give much trouble when you try to get it out. The bottom of a post can usually be got out by sticking something in the hole and pulling.

The old post having been removed, leaving the horizontal rails free and in good condition, a new post must be mortised



POSTS POINTED WRONG POINT

to tally with the old one. To get the proper depth for the hole, deepen the existing one slightly. It is easier to fill up the hole a little with rubble than to dig it out when the post is in. Put the rails into the bottom, mortise first, and gently lower the post into the hole, placing the rails in position consecutively. If the post is too low pack up the bottom with broken brick or stones. To replace a broken rail on this sort of rustic fence do not take out two of the posts, but make a long tenon on one end of the new rail and drive it into one of the mortises until the other end clears the opposite post and can be driven back again into its mortise.



STRONG RUSTIC FENCE

The upper left-hand cut is a fence which can be made very low as a garden edging or up to three feet as a fence. Taper the cross stakes on all four sides, if square, to make a point, and symmetrically to a point if round. The type shown is seen in both rustic and trellis work. If in rustic work, strips may be straight branches cut in halves down their length.

Where time can be spent on the work in searching for suitable pieces of wood and in mortising, a good design for the top of a rustic fence is as shown. The center boss is a close grained piece of oak, elm, alder or beech. The diagonally placed pieces are mortised into this and secured at their opposite ends with nails. The dotted lines indicate another form. Suitably curved pieces of wood are mortised and tenoned into the horizontal and vertical main pieces.

Over and Over Again

(*Continued from page* 404)

started doing stunts, and what I would do if I were afraid! But the time passed quickly, and, after consulting my altimeter, I decided to start barrel rolling. I made sure everything was all right, pushed forward a trifle on the stick, pulled it into a corner, and went into my first barrel roll. I had to watch carefully to come out straight. But after it was over I knew there was nothing to be scared about and did thirteen in rapid succession. By that time I had lost considerable altitude, and had to climb a bit before doing any more of my stunts. Then I did twenty-one without stopping to gain altitude.

While climbing a second time I looked down to see if I could discern the markers on the ground. They were very plain, and a completed cross told me I had done at least thirty rolls. Then I did thirty-two more, one after the other.

My sixty-seventh roll was not perfect, so I thought I'd call it a day. It was better to stop now than do something wrong and be sorry after. At 1,500 feet, directly over the airport, I cut my motor and glided, in two complete circles, to a landing. This is required in taking a test for a pilot's license, and, as I had done it many times with Mr. Lund, I felt sure I could do it myself.

When I landed, I taxied back to the hangar where the boys were waiting to congratulate me. My husband gave a sigh of relief, for although he was confident I'd come through all right, he couldn't help worrying while I was so high up, all by myself.

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Traveling—Straight Down

(*Continued from page* 408)

a point 8,000 feet above London. The misbehavior of his 'chute on this occasion stimulated an English artist, Robert Cocking, to try to build a better one. The Cocking 'chute was braced with wires and slats to hold it rigid. It didn't work, but disintegrated near the end of a 5,000-foot drop, and the inventor was killed.

The ballooning craze that swept the western world in the latter half of the Nineteenth Century brought two men, Van Tassel and Baldwin, to the top of the parachuting heap. They and their apprentices practically monopolized the business, developing around it a thousand odd and dangerous tricks to satisfy the demand for thrills on the part of the spectators. But the 'chutes employed by these performers were all of the "attached" type. The "free" 'chute was developed by Charlie Broadwick and A. Leo Stevens.

In the Broadwick 'chute, a cord attached to the balloon or plane pulled the canopy from its pack. Stevens, however, devised a rip-cord, thus making the 'chute and its wearer completely independent of the craft on which they ascended, and minimizing the chances of fouling the lines.

The gods had their usual laugh at progress when they permitted the Stevens 'chute to be used solely for exhibition jumps, while birdman after birdman, including such fellows as Lincoln Beachey and Cal Rogers, plunged in frail planes to their death. They continued their chuckles when the center of interest swung to the Broadwick 'chute and the government bought a few and—laid them on the shelf, while the War came on apace. Their

Irving Air Chute Co., Inc.

The Irving parachute for passengers is carried like luggage, but can be instantly attached to the snaphooks on the harness, in case of emergency.

mirth hardly abated while the army flyers of all the warring nations batted the earth in distorted heaps until the fall of 1917. Nor when, following the example of the Germans, the Allies began to equip their pilots with *attached* 'chutes, which fouled in emergencies and carried the pilots swinging down to a last fatal slam beneath their disabled or flaming ships. One is not sure that the gods sobered either, when after the struggle the United States spent three-quarters of a million dollars to rediscover the free pack, rip-cord operated 'chute, apparently ignorant of the fact that it had already been invented and demonstrated by Stevens—whom his country had kept busy building attached 'chutes for the balloon corps during the War!

But after the fighting the American army did develop a satisfactory free parachute. A group working under the direction of Major Hoffman, at McCook Field, achieved this objective in 1919. And Leslie Irvin, a civilian, made the first successful jump. A contract for the first lot of the new 'chutes was his reward. As chief engineer of the Irving Air Chute Company, he has furnished and is furnishing a good share of the world with improved forms of the 'chute developed by the Hoffman outfit, distinguishing feature of which is the pilot 'chute—a two-foot canopy sprung into the air-stream when the rip-cord is yanked, hauling the main 'chute in its wake.

In 1924, James M. Russell, one of the Hoffman group, resigned from the army and developed a new type of 'chute, the "lobe," primarily for commercial transport use. He eliminated the pilot canopy and added an in-curving skirt, through the lower edge of which the lines passed to the 'chute proper, but to which they were not attached. This was the "lobe" that gave the new 'chute its name.

In tests here and abroad the lobe 'chute opened faster with less shock, opened more positively, and swayed less in descent than any other 'chute tried. The lobe feature permitted the air pressure inside the canopy to adjust itself to the varying air pressures met as the descent was made. After intensive experiment, Russell succeeded in making the 'chute operate positively in many tests, regardless of the manner in which it was folded or of the position of the lines. The new 'chute was practically "foul" proof.

The next big practical development of the 'chute probably will be the canopy which will lower to earth, without damage, a whole plane with its cargo or passengers. Nor, from all reports, will this development be long in arriving.

Note.—The basis for this article is the material contained in *Parachute*, a book by Charles J. V. Murphy, published by G. P. Putnam's Sons, 1930.

Solution to CROSS-WORD PUZZLE On Page 448

■	1	8	6	1	■	1	9	4	9	■
1	9	8	2	8	■	1	8	0	4	0
8	1	■	2	5	1	2	3	■	9	0
1	8	6	■	6	7	2	■	1	8	0
2	3	5	6	0	■	6	6	6	2	1
■	■	5	6	■	7	■	2	0	■	■
4	6	8	7	5	■	2	4	8	8	6
1	2	8	■	7	9	2	■	8	7	5
3	0	■	9	8	6	9	9	■	1	6
6	2	7	9	8	■	6	6	3	6	0
■	1	5	9	8	■	8	5	1	2	■

A Rock Garden

(*Continued from page* 404)

to this purpose. Particularly effective are the sedums, the thick-leaved little succulents which ultimately spread over the rocks and bloom with tiny blossoms at various periods, forming a most attractive carpet of several shades of green. Cotyledons are also desirable, as are creeping veronicas and bellflowers, valencias, thymes, candytufts, helianthums, saxafrages, campanulas and a seemingly endless list upon which your local nurseryman will advise you for proper groupings. Pockets can be made for dwarf tulips and grassy pinks, and bright yellow alyssum saxatile set out at the base.

By all means arrange a background of shrubbery or, as the writer did for quick growth, a trellis with vines such as honeysuckle or even morning glory, while the more leisurely English ivy is growing.

If you have a sloping area in your lawn, one too steep to retain moisture for conventional plantings, a sloping rock wall can be constructed similar to the rock garden illustrated which will greatly improve the vista.

Electric Fingers

(*Continued from page* 414)

card, which pertains to the color and tenure of farm operators.

The cards are placed in the hopper of the sorting machine, and are automatically fed one by one through the machine, which electrically sorts them into the corresponding pockets of the machine. The principle upon which the machine operates is that of an electrical contact through the punched holes. Twelve pockets correspond to the positions in each column of the card. Accordingly, the cards that are punched in the first position of the given column, which denotes that the farm operator is a white owner, are sorted into the corresponding pocket of the sorting machine.

This marvelous device, the electric sorting machine, operates at a speed of 400 cards per minute. Each card pocket holds approximately 800 tabulating cards and is equipped with an automatic pocket stop which operates when any pocket is full.

After they have been classified, the cards are ready for electric tabulating and accounting machines by means of which totals are aggregated and printed. The cards are placed in the hopper of the tabulating machine, and are automatically fed one after the other through the machine at a speed of 150 cards per minute, adding the amounts upon counters, and stopping at the end of the group and printing the totals. Now, let us examine the printed result sheet in the carriage, to find the answer to our quest for statistics concerning the number of white owners, colored owners, white renters, and colored renters in Kiowa Township, Pittsburg County, Oklahoma. There on the result sheet we have our answer!

The magnitude of the task of tabulating the data of the Fifteenth Decennial Census is shown in the facts that more than 400,000,000 tabulating cards are being used in this giant statistical enterprise; more than 200,000,000 in the Census of Agriculture, 170,000,000 in the Census of Population, and many millions more in the Censuses of Manufactures and Distribution. The International Business Machines Corporation is furnishing the tabulating cards as well as other tabulating equipment, supplying key punches, verifying machines, electric duplicating key punches, electric sorting machines, and electric tabulating and accounting machines.

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Basement Plan Awards

(*Continued from page* 410)

marvel at a basement room as livable as ours. Needless to say, we do most of our entertaining down there. It is well lighted with four casement windows. The walls and ceiling are kalsomined tan and the floor is cement which we some day hope to cover with a flagstone linoleum. However, now we have painted the floor red and have a large rug over it which makes it comfortable and warm. There are two ceiling lights and floor plugs. The two radiators are on the ceiling which saves space and keeps the room heated more completely. The woodwork and radiators are painted brown.

Carpenter's Bench Included

In the picture one can see the door into the storeroom. One window is sufficient for this room. Here our luggage is stored and a carpenter bench affords practical recreation. Conveniently near is the door to the furnace room where the oil furnace is located and where the fire logs are kept. This room is kalsomined white and stays that way. The other door from the storeroom leads to the maid's room which is kalsomined in green. There are two windows which insure ventilation and protect against dampness. A ceiling radiator heats the room. On the floor is a large congoleum rug and small rag rugs. In the hallway off the storeroom is the shower. In order to save space the shower was put between the basin and the toilet as the room is only three feet wide and about six feet long. This we find very convenient and most practical. The other door from the hallway opens to the laundry. It is a good-sized room with plenty of space for two clothes racks, an ironing board, closet under the back stairs, two laundry tubs, a large table and shelves for canned goods. This room is also kalsomined in green. Two windows and ceiling radiator insure quick drying. There is a ceiling light and lights over the laundry tubs.

There is absolutely no sense in having a dirty basement and waste space is always untidy and dirty. Therefore, if you have a basement, old or new, start planning right now. Cement it first—it is easy to clean—a few pails of water work wonders. If it is poorly ventilated and dark, cut some windows and put in lights. But plan first. Decide how you will want to use it and then get to work. You will be surprised and pleased, your friends will admire and envy you. You will add to the value of your home greatly, too.

$5,000 FOR PERPETUAL MOTION

The editors have received thousands of different designs of perpetual motion devices, and have received hundreds of circular letters soliciting finances for the building of perpetual motion machines.

The editors know that if they receive these letters, there are thousands of others in this country who get similar letters and who fall for the claims made in the numerous prospectuses giving the earning capacities of the various machines.

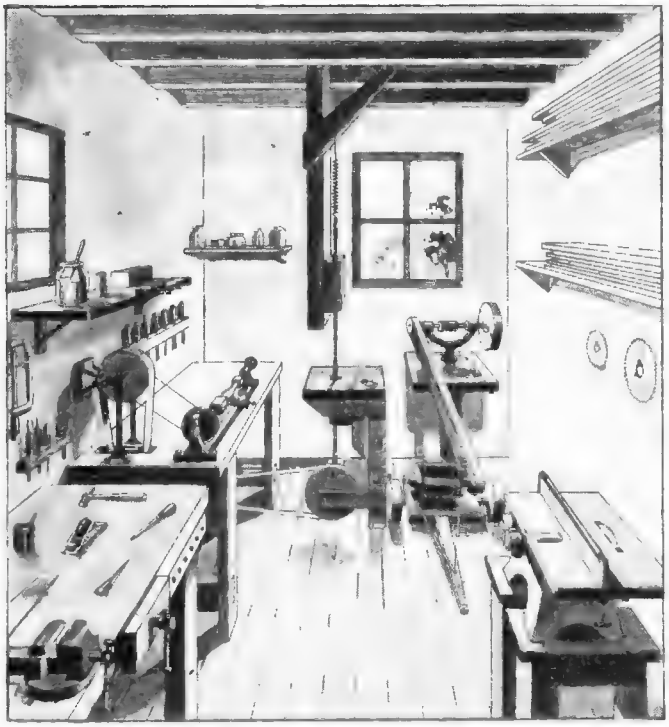
Most of the shares of stock for these perpetual motion machines are being sold at a rate of $1.00 per share, although some inventors are trying to sell shares of stock at $100.00 per share.

Therefore, the editors of this publication say, "Just come in and show us—merely SHOW us—a working model of a perpetual motion machine and we will give you $5,000.00. But the machine must not be made to operate by tides, winds, waterpower, natural evaporation or humidity. It must be perpetual motion."

Awards in Workshop and Handicraft Contests

Home Workshop Contest
Ended July 15
First Prize $10.00
B. E. Rogers, Raleigh, N. C.
Second Prize $5.00
Dale R. Van Horn, Lincoln, Neb.

Handicraft Contest
Ended June 15
First Prize $25.00
John Steinke, Cleveland, O.
Second Prize $15.00
Gale Vance, Lincoln, Neb.
Third Prize $10.00
J. E. Lovett, Lancs., England
Fourth Prize $5.00
Elmer Verburg, Grandville, Mich.



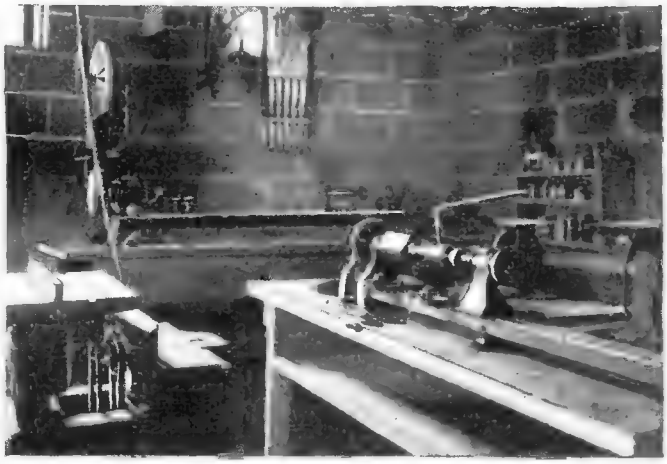
Above appear a photograph and a sketch showing the workshop of B. E. Rogers, Raleigh, N. C., winner of First Prize in the Workshop Contest closed July 15. It scores high in completeness, compactness, practicability, and ingenuity of arrangement.

My Workshop

By B. E. Rogers
First Prize Winner, Workshop Contest

MY floor space is only ten by eighteen feet. I have a combination rip-saw and jointer, placed in line with an emery wheel near a window at the rear. My motor is on block wheels, permitting me to run either unit from the same belt by changing the position of the prime mover. My jig-saw is near the center, in line with my wood lathe, and is operated by an eccentric rod on the pulley; it is connected with a guide which holds it in position, and above the table is another guide placed on a 2×4 fastened to a joist. A coil spring raises it when the eccentric pulls it down. By placing the motor directly under the lathe pulley I operate both machines without changing its position. I am 71 years old.

Note Important Announcement on Page 468, Relative to These Contests.



The compact, practical basement workshop of Dale R. Van Horn, awarded Second Prize in the Workshop Contest.

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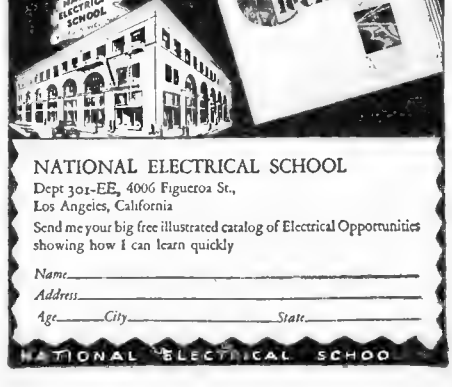

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"New hair came almost immediately after I began using Kotalko," he writes, "and kept on growing. In a short time I had a splendid head of hair, which has been perfect ever since."

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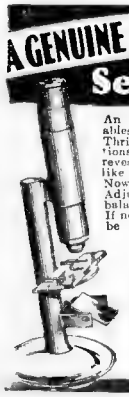

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We Have to Clear the Way for the Biggest and Best

TO give a clear field for what we believe to be the biggest and best contest ever staged in the practical mechanics line, the editors have decided, somewhat regretfully, to suspend the Home Workshop and Handicraft Contests for the time being. . . . This does not mean that we shall not be pleased to receive from our readers photographs and descriptions of their workshops, or illustrated constructor details on things they have built. On the contrary—we shall make a point of accepting them for publication if in our judgment they are suitable, paying for them at our regular rates. But we feel that the contest for which we are preparing demands, by its very excellence, the center of the stage. And we believe that next month, when the details are divulged to you, you will agree with us to the limit.

HAVE You Read the Very Interesting First Prize Basement Plan Story on Page 410? Watch for the Others—to Be Published in SCIENCE AND INVENTION for October and November Respectively.

Make a Jewelled Table Lamp

(*Continued from page* 439)

six riser pieces and bend them in the same manner as shown in Fig. 5 for the panel. Solder the six pieces with just a drop of solder to the corners of the top piece. Now set the tower on the shade and lightly solder it on the inside. If the tower is all true, sweat solder in place on all corners of the tower. Solder in the little clips on the top piece to hold the glass or parchment in place.

To complete the shade, solder on the middle clip, and along the edges of the panels, so no light will shine through the crack of the lamp. Cut a dozen little slivers of metal which you solder along the bars of the bottom design, so they can be bent over to hold the glass in place.

Cut six pieces of hexagonal brass or iron rod 20 inches long for the stand and with a mallet bend the bottom curve over a block as can be seen in Fig. 8. Bend the larger curves by hand over a block. (Fig. 9.) Fit each piece to the layout drawing you made of the leg. Saw a shoulder on the bottom of each leg as indicated in the layout drawing of the leg (also see Fig. 10). The legs are fastened into the bottom ring which can be cut from a solid piece, but a piece of copper large and thick enough for a ring would cost more than all the other material together. Just as effective and a much more inexpensive way is to cut the ring from lighter copper, allowing ¼ inch edges as shown in the drawing, turning the edges over with a hammer. Fill this ring with lead. Now pound a bevel on both sides of the ring (Fig. 11). Put small hammer

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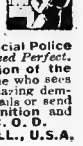

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THE Imperial Aircraft Corporation of Camden, N. J., offers its German Ace primary glider either as a completely assembled ship, or as a partially assembled but completely manufactured ship, or as a ship partly in the rough (plywood parts in sheet form), complete except for wires, bolts, turnbuckles and covering.

The latter forms should appeal to glider clubs especially. The third form—designated as Outfit Number 2—can be had for less than a hundred dollars, f.o.b. Camden, with a complete set of jigs for building ribs, ailerons, stabilizers, elevators, and rudder included. Instructions for building and tools come with the outfit.

The Imperial glider is described as a training ship designed for rough use, constructed of selected airplane spruce, ash, and government standard waterproof birch and mahogany plywood. All wires and fittings are designed to facilitate quick dismantling. The fuselage is of two-piece design, permitting removal of the tail from the cabane in a short space of time. The wings also are of quickly detachable type. The weight of the ship, empty, is 165 pounds and the wing span is 32'6".

Jewelled Table Lamp

(*Continued from page* 468)

marks on the flat part of the ring after which you drill holes for the legs of the stand, locating them from the drawing. Now assemble all the legs tying them together with twine and square up your stand. Set a ruler across the ring and on it place two squares or right angles of cardboard. Do this on several sides of the stand to square it up. See Fig. 12. When your stand is all trued up, solder it but only where the copper bands come. Turn up the ring and solder the legs on the under side so you can make a flush job of soldering.

Hammer mark the rings to go on the stand, soldering them on the back. Scrape the solder down right into the copper so the seam will not be noticeable. Glue a piece of felt on the bottom to prevent marring of furniture. The rim of an old felt hat works to perfection.

Now make the stand holders from the drawings, wrap the wider end on each leg, bend up the other part, fold in and fit over the seams in each panel. True up your shade so it stands level on the stand. Then solder the holders on each corner after which sweat on a little triangular re-inforcing piece. The close-up of this stand-holder is shown in Fig 13.

Now for the socket bracket for the lamp with a tower. The band iron is laid out from the drawings and bent in a vise. The photograph shows the copper support fastened on one side. If you omit the tower, you will only need a flat bar with two sockets. The socket bracket with the sockets is removable by taking off the two nuts from the copper support. This enables you to replace the bulb in the tower.

Clean the lamp with dilute muriatic acid or a *weak* solution of nitric acid. Make a swab by wrapping cotton cloth around a stick and thoroughly wash the lamp. Keep your fingers from the acid.

If you wish a bright copper effect go over the entire lamp with fine sand paper and steel wool. To preserve the brightness of the copper, lacquer it with banana oil. Most people, however, prefer an antique finish. If you want green, bathe the lamp with a solution of sal ammoniac and water. This will have to be swabbed on a good many times before you get a fine coat all over. For a dark tone use a sulphide of sodium solution and bathe the entire lamp with the mixture several times. Sand the high spots as shown in Fig. 15. Now wax the metal with a paste furniture or automobile polish. Do not use a liquid polish. You may burnish the job with a burnisher or any rounded piece of highly polished steel. Wax it. burnish it, and then rewax it. Always rub your burnisher in one direction. Burnishing is well worth while.

Cement the jewels into place with ambroid cement. Stones cemented with ambroid are held strongly enough for all ordinary wiping of the lamp. Should a stone become dislodged, it can be easily re-cemented.

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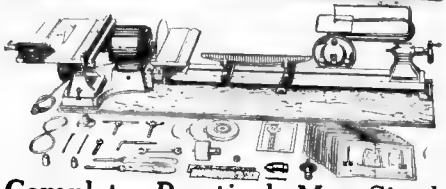

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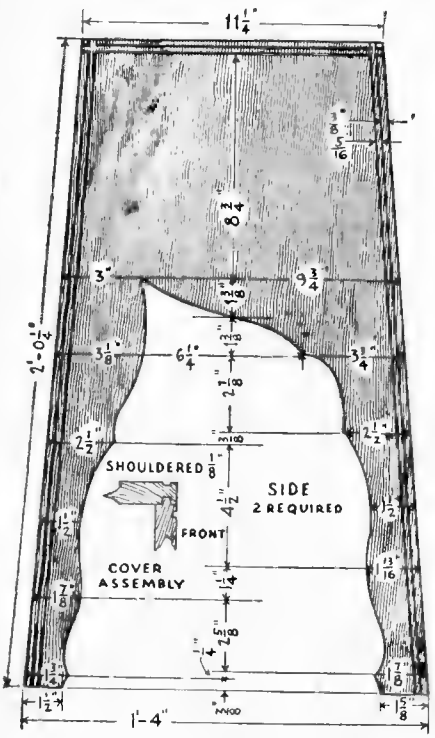
A Distinctive Telephone Table

(Continued from page 433)

ing cutter knives in the cutter head which will give the desired cut, adjust, and run the shallow groove across the top and down the edges of each of the four pieces, about 3/8" from the finished edge. Note that the spacing is different for the sides of the front and back, as a 3/8" tongue is provided here to mortise into the sides. The spacing of the side grooves for the front and back then, is 3/4" instead of 3/8". This step throws the grooves up in strong contrast to the rest of the panel because the groove bottom is in the natural wood color again.

Now apply a good coat of clear lacquer to all four pieces and let this dry from 1 to 6 hours, depending upon the humidity and temperature of the room. At the end of this time, rub down with fine steel wool and polish on the buffer. Then cut the tongues on the edges of the front and back either with the power jointer rabbeting edge, or with the crosscut saw and cut back the portion at the lower end of each tongue as shown by the dotted lines.



To make the mortises for these tongues, you can best use the dado head and when cutting the tongues be sure that they are going to fit (not too tightly) the dado cuts. Since the dado cutting is done "blind" be sure to locate points on the

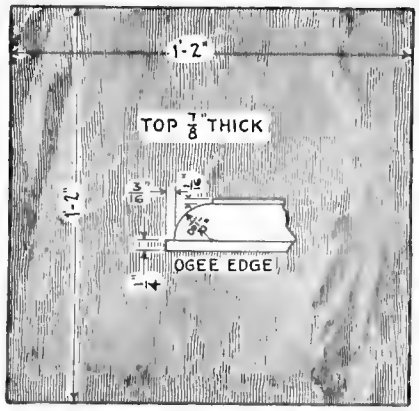
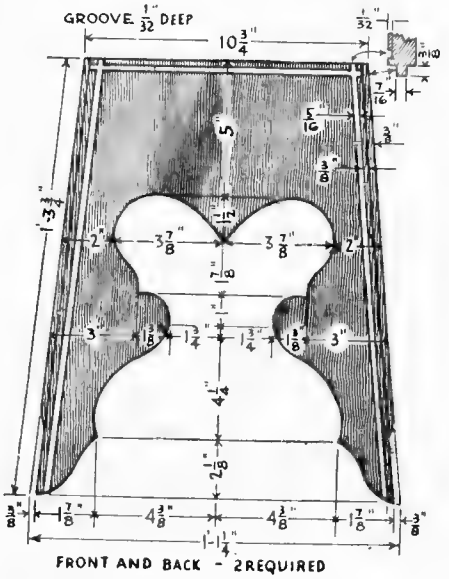


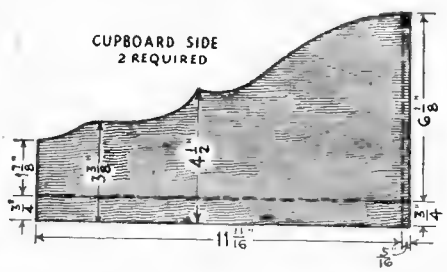
table and other points on the work, that you will not accidentally run past the limit and cause a bit of mortise to show. And, at this point, it will be a good plan to assemble the pieces temporarily, to see that they fit. The last cutting to be done on each of the four pieces below the top consists of a saw cut part way through each piece, about 3/8" below the top to take the locking end of ordinary top fasteners. Care should, of course, be taken that these cuts do not extend clear to the edges.

The top is a single board 7/8" thick and 14" square. Use the bowed side up, if there is any appreciable warp, and cut a neat edge carefully with your molding cutter. Take care at the finish of the



cuts across the grain to prevent splitting or breaking the wood at the corners as a slight blemish here will be noticeable. This piece is also filled, stained and rubbed down with steel wool with proper drying intervals between surface applications of liquids.

Of course, you want a glasslike surface. One of the best ways is to spray on lacquer which has been diluted 50% with thinner. Play the spray back and forth a number of times to build up a



smooth, thick coat. Then go over this with a sandpaper block, with the grain, and finally dress down with the finest steel wool you have. Or powdered pumice on a cloth pad will do the trick nicely.

In the super-structure, there are two side pieces of the shape shown, a back and the top and shelf. A tongue is cut on the lower edge of each side piece, the lower edge of the back, and at each end of the shelf, of the dimensions shown. Since the curves of the front edges of the sides need not be exact, you can transfer by eye, directly from the pattern shown

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33x4	2.95	1.10	29x5.00	2.75	1.10
34x4	2.95	1.00	29x5.00	2.75	1.10
30x4½	3.25	1.25	30x4.50	2.45	1.10
33x4½	3.25	1.25	30x4.95	2.90	1.25
34x4½	3.25	1.25	30x5.25	3.05	1.25
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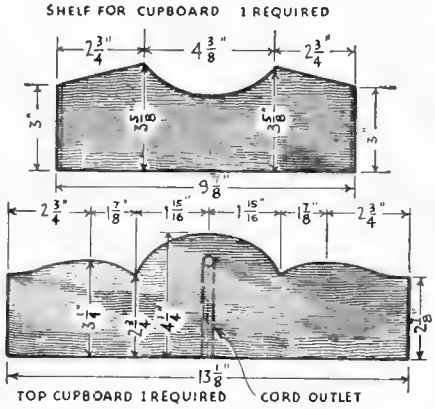
(*Continued from page* 470)

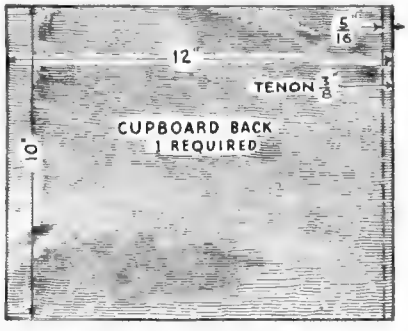
if you wish. The inner back edge of each side is routed out on the jointer, the thickness of the back wide, and about ⅜" deep so these three pieces will fit flush.



Sand, fill, stain and lacquer, before cutting the grooves and tenons so that a fresh clean edge results. The top and shelf are cut with paper patterns to insure symmetry. Cut very shallow tenons for the shelf ends and cut the mortises for them with the hammer and chisel after locating them and outlining with pencil. As with other pieces, cut the ends of the tongue away so no portion of the groove can possibly show.

Grooves for the tongues of the sides and back are in like manner transferred to the top itself and then cut with hammer and chisel. While you can set the top in any relation to the lower part you wish, the best spacing will be for the back surface of the back to be in line with the top of the back below the top.

For the light you will need a hole leading in from the back, shown by the dotted lines. Then connect with a short hole bored in the under side of the top. A small brass flange, threaded to take an ordinary socket, is fastened here with screws, and the assembly is done last of all.



You will note that the application of the lacquer, even though clear, slightly darkens the fresh wood of the grooves of the pieces below the top. So much the better: the contrast is thus well toned.

Now set all parts together to make sure that they are going to fit. Then take apart and run a best quality glue along the grooves for the front and back tenons. Then assemble the four pieces quickly. Lock the top and bottom if necessary with sticks as shown for a few minutes until the glue sets, to insure a snug fit. When the glue holding these has set, remove the braces and, turning the frame upside down, fasten the top in place with the metal fasteners—a single screw through each into the underside of the top. Draw down tightly and put two fasteners to the side. Also test for squareness. If an obstinate deviation from the "square" persists, it will be necessary to again brace for some time.

Continue the assembly, next gluing the

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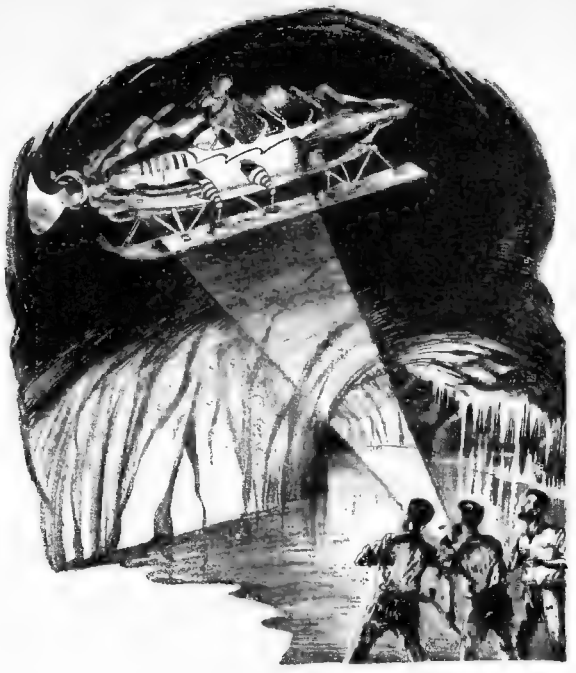

"The strange mechanism sped around the cavern, then around on the walls and finally made several circuits of the roof in an upside-down position." . . . *Illustration from the unique story of three years spent in underground caverns, appearing in the September* AMAZING STORIES.

5 Great Features in the Sept. AMAZING STORIES

"THE TROGLODYTES"

All the possibilities of exploration in the Mammoth Caves in Kentucky have not been exhausted by any means. There are still vast caverns and bottomless pits that have not been entered as yet, for it is dangerous business. In Carlsbad, recently, another cave was discovered that, by its sheer immensity, puts other caves to shame. Day after day explorers penetrate deeper and disclose new wonders. In this story Mr. Barclay goes deeper than any explorers and thrillingly pictures many untold possibilities.

"SKYLARK THREE"

Dr. Smith, famous author of "The Skylark of Space," continues with the second part of his exciting and inspiring intergalactic space story. Don't miss it!

"THE PASSING STAR"

The earth was born when billions of years ago another great star passed our sun. What would happen today if an "outside" star came into our solar system? Isaac R. Nathanson has written a marvelous story around such a phenomenon.

"THE TRANSLATION OF JOHN FORSYTHE"

Edmund W. Putnam has contributed an excellent scientific story on the possibility of living beings existing about us who are beyond our vision.

"FREE ENERGY"

The earth rotates like a gigantic armature. Electricity is everywhere in the air. In Harl Vincent's story this enormous free energy is captured and put to work with amazing consequences.

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top sides, shelf and back together and in the mortise in the top. See that each piece fits squarely. The back can be fastened also with small finish nails, since these won't show. Finally the top is nailed on with finish nails whose heads are countersunk and the holes smoothed with filler mixed stiff like putty. Then wire for the lamp and use one of the small shields now so popular in front to dim its glare. Be sure to set the shelf low enough to clear the light nicely.

Let the finished piece stand over night. In the morning the surface should be waxed after first wiping clean with a rag. Or, if the finish can stand another coat, apply a second, let this dry and rub down with steel wool. Then wax.

One excellent way to take care of the phone book is to cut a slot through the front panel just under the top and set in two thin veneer pieces wide enough to take the book easily and put a block at the back at a point which will cause the book to protrude about ½"—far enough to be pulled out easily. Or, a shallow drawer can be used. However, the book will sit very nicely under the phone.

When you assemble the four pieces of the lower part, it will be well to fasten both ends with cleats to hold the glued joints tightly together until they have set.

A Pneumatic Repeater

HERE is a twenty-shot repeating air rifle of remarkable penetrating power. Most of the rifles that are called air rifles are really spring guns. This one actually has an air chamber in which air can be pumped to a pressure of 600 pounds to the square inch. At this pressure the lead pellet that is fired from this gun develops a muzzle velocity of 700 feet per second. The coast of the lead pells is much less than powder-filled cartridges, and the nature of the rifle permits of adjustable power. The gun need never be cleaned. The editors have been able to penetrate a ⅞" pine board with lead pellets that were fired noiselessly from this gun. The pump for supplying the compressed air is shown in this photograph, partly open.

Courtesy Crosman Arms Co., Inc.

The Crosman pneumatic repeater, with pump mechanism in partly open position.

Rust Remover and Preventer

THE rust from iron and steel may be removed by applying this compound: 1 part of glycerin, 2 parts caustic soda, 32 parts washing soda crystals and a little permanganate of potash dissolved in a few drops of water. This solution also acts as a rust-resister.

Seavak Framroze Desai.

Automatic Machines Lap and Polish Crankshafts

BEARINGS of the Ford crankshaft are being polished to a much finer degree as the result of the development of machines that finish all seven main and connecting-rod bearings in a single operation.

After the crankshaft has received its final grinding and has been statically and dynamically balanced it is placed in a specially built lapping machine which has seven arms—one for each bearing. Each arm holds six very fine lapping stones or hones which clamp around the bearings under heavy pressure. The shaft is rotated and also oscillated until no roughness from the grinding operations remains.

To insure an absolutely smooth and bright finish, the shaft is then placed in a similar machine which holds an extra fine polishing paper instead of the lapping stones. Again it is rotated and oscillated after which the bearings are cleaned and inspected.

This process gives the bearings a mirror-like smoothness which reduces friction and makes easier the breaking-in period of the car. The polishing paper used in the second machine is fed automatically so that there is a fresh supply for each crankshaft. This, with the oscillating motion, permits a more uniform finish than was possible under the old method of polishing each bearing separately.

Polishing paper, fed automatically by this machine, gives the crankshaft a fine finish.

Wire-Stripping Device for Pliers

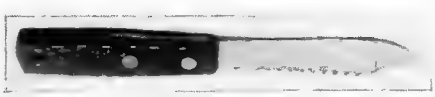
AN improvement in plier design, covered by a patent pending to P. F. Reichhelm of the American Swiss File and Tool Company, widens the function of the tool to include cutting and stripping insulation from wires.

The innovation can be applied to any plier. The bows or handles are converted into a stripper, and two cutting jaws are added. The plier ends are so designed that the jaws cut through the insulation but not into the wire itself. A couple of twists severs a section of the covering, and a single pull serves for the stripping operation. Beveled cutting jaws at the side of the stripping jaws provide a means of cutting the wire, if this is desired.

Inexpensive Sheath Knife

A NEW sheath knife, retailing for $1.00, has been put on the market by the Remington Arms Company. It is practical for the hunter or trapper who needs a sturdy knife, small in size and light in weight, is good for the fisherman, and can be used by junior outdoor folk.

The blade is 4½" long, forged and hardened and tempered; it has a full mirror



finish. The handle is of shin bonestag. It comes with an oak tan cowhide sheath and a snap fastener loop to hold the knife.

Simple Electric Burglar Alarm for Safes

FOR the merchants who have small safes and want protection at a reasonable cost, and for those with large safes, the illustrated burglar alarm, patented by Sol Pasman, presents a simple attachment.

The device is easily fastened to the door of the safe or vault and exhibits a series of chain loops that appear to hang in front of the combination. These chains are connected with suitable relays which close the circuit to the alarm. A slight motion of the chains or cutting of the wires sets off the gong.

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Scientific Book Reviews

By Dr. T. O'Conor Sloane, Ph.D.

MATTER AND RADIATION WITH PARTICULAR REFERENCE TO THE DETECTION AND USES OF THE INFRA-RED RAYS, by John Buckingham, M.A. Oxford University Press, 1930. Pages XII—144.

The author of this book is now in the service of the British Admiralty, having been previously connected with Cambridge University, and has given an exceptionally interesting treatise on radiation. In one place he seems to part with regret from what he calls the "austere beauty of mathematics." In other words, he has made the book so simple that it is readable. But in his efforts to make it simple (and he seems hardly sure that he has done so), he does not impair his treatment of the subject.

It is interesting to find him calling Heinrich Hertz the pioneer of modern radio. It is hard for those of us who have lived through the development of radio to realize that the work of the great German physicist was done some forty years ago. A very interesting feature is that the author goes far back into 1362 B. C. to ancient Egypt, giving the views of King Amenophis IV on the functions of the sun. He also quotes from Leonard da Vinci, and shows the appreciation of old time work which is very interesting and gives a clue to the general treatment of the subject. One of Herschel's experiments in infra-red rays is described, for instance, with the quaint old apparatus illustrated. Faraday and Clark Maxwell are brought in. The reason these names are cited by the writer of this review is to show what an interesting personal touch our author gives his subject. Another interesting feature of the book is that at the end of the chapters lists of references are given which constitute a real bibliography. The only fault we can find with this book is that it has no index.

A GERMAN-ENGLISH TECHNICAL AND SCIENTIFIC DICTIONARY, by A. Webel. Published by E. P. Dutton & Co., 1930. Pages XII—887.

This dictionary is for use in sending codes by telegram or cable. In the beginning we have coding tables by which words can be expressed by numbers, given in two sections, one in English and one in German. The preface is also given both in English and in German. After the coding system is studied out the user may turn to the dictionary and there in its nearly 900 pages a large selection of words, some of them very unusual, will be found. To show how thorough the work is, we may note that the names of the rarer chemicals are included. The idea evidently is to cover exhaustively the general commercial requirements. After the dictionary proper, a list of chemical elements, German and English, atomic weights and general data are given along with a code number for each element. Then come abbreviations, of which our German cousins are very fond. Some fourteen pages are devoted to these abbreviations with a code number for each. The same is done for signs and symbols and a very long botanical section of about 140 pages ends the book.

Comment on other scientific books appears under *The Way I See It*

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In RADIO NEWS *For September*

The second article of the series by E. K. Oxner on the Hopkins Band Rejector Systems shows its application to the intermediate amplifier of superheterodyne.

Charles R. Wexler gives some practical solutions to the problems encountered in automobile radio installations.

The part played by radio in the filming of "Trader Horn" in British East Africa is graphically told in an article by L. Elden Smith, with full descriptions of the transmitter and receiver used.

Television has advanced from the laboratory to the theatre. The radical improvements recently made in this art are fully detailed in Edgar H. Felix's article "Television Advances from Peephole to Screen."

The remarkable detector-amplifier characteristics of the Loftin-White System are utilized in a superheterodyne receiver described by George E. Fleming. The first article of the series appears this month.

The radio set owner is no longer satisfied just because his receiver apparently works the way it should, but demands graphs, curves, and other data to substantiate the manufacturer's claims. The laboratory tests made on receivers to supply this data as well as insure satisfactory operation, are described in full by Glenn H. Browning and James Millen.

Inlay Effects in Wood Can Be Economically Produced

THE color trend in wood has had considerable to do with developing a demand for decorative inlaid work abroad and here, with the result that there are several remarkably simple processes in use as compared with the slow, tedious and expensive processes of the past. In one process a sketch is made of the design which it is intended to inlay direct upon the smooth surface of the birch, maple or other wood as shown in Figure 1.

In some of the shops which we visited in France and in this country, the design thus made was cut out with a saw in the single piece.

In the larger plants, where the work was mechanically accomplished, five, ten and sometimes fifteen pieces were simultaneously cut. Once the designs are cut in the pieces, the filling of the cavities with a substance different in texture or color from the ground is easy and cheap. In many cases that part of the wood which is cut out as shown in Figure 2 can be held sufficiently intact to use as the inlay material in panels of a different color but which were cut at the same time. A thin veneering cemented to the back serves to hold the inlaid part securely in place.

Fig. 1. *The sketch made directly on the surface of the wood is cut out along the white lines.*

The introduction of cellulose viscose substances for the manufacture of artificial silk has produced a new material for use as filler in the making of imitation inlaid work. When the design is in the form shown in Figure 3 its cavities are in readiness for filling with a material of different color. Cellulose viscose is being used for this purpose with satisfactory results. Instead of drawing the pulp into filaments for artificial silk manufacture, the pulp is used in its soft condition like any melted substance. It is poured into the cavities of the design and allowed to harden there. The stuff possesses about the same affinity for dye colors as any vegetable substance and usually is colored in the vats while still in a pulp state.

Sometimes the prepared cellulose viscose is procured from the pulp mills in solid form and is reduced to a fluid condition by heating in a vat.

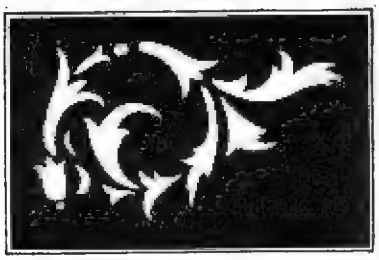

Fig. 2. *The white areas show the wood that has been cut out. This can be used for inlays on wood of different color.*

In another method of producing imitation inlaid work the design of a landscape, flowers, animal or bird life is traced on the wood plaque. Then these tracings are gone over with a sharp-pointed tool sufficiently deep to make cuts similar to those made by a scroll-saw; only not entirely through the thickness of the wood. A coating of shellac is applied inside the outlines and allowed to dry for several hours, after which the color is put on by dipping. An inlaid effect of this type is adaptable for gluing to an object. Some of the panels thus produced can be seen on furniture. Sometimes the stain is applied with a brush in lieu of dipping. After the stain has thoroughly set the shellac is removed with alcohol. This kind of imitation of inlaid work is referred to as "stain painting" in some establishments, and various water color stains are employed for the purpose. Often more than one coat of the stain will be necessary, depending on the percentage of tannic acid in the wood. Different woods take the stain differently as all know who have done any staining of wood. Whether the water or the oil stains are used, it is advisable to let a first coat dry thoroughly before applying the second coat. If the inlaid work is in birch, and an imitation of walnut is desired, a water stain can be used advantageously for a dark tone, but for a medium tone an oil stain with an asphaltum base is recommended.

The final operation on the panel consists in applying linseed oil to the surface and finishing off just about the same as work of this nature is completed in the staining and finishing department of a furniture or general woodworking factory.

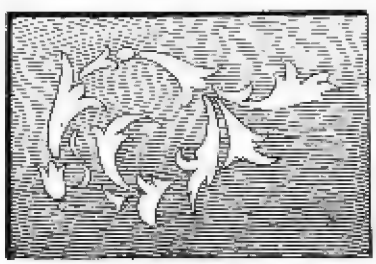

Fig. 3. *The cavities in the wood are in readiness for filling with cellulose viscose or other suitable material.*

A Device for Catching Poultry

IT is very difficult to catch chickens from a flock, in a house, or out on range without frightening them. With a piece of fence wire bent in the shape of a shepherd's crook at one end it is very easy. The piece of wire should be about six feet long, or may be made of a shorter piece mounted on the end of a piece of light bamboo fish pole. I prefer the wire alone as it is less noticeable. Bend up about four and one-half inches of one end, bending point out and with sides of loop far enough apart to admit the leg easily, but not far enough apart to let the foot slip through. Throw down a little grain, then while they are busy slip the crook over the leg of the chicken wanted, and you have it.—*Miss Emily Dinsmore.*

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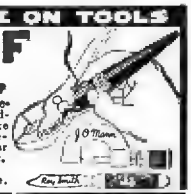

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Entertain with These Musical Glasses

By Kenneth Bronaldo Murray

The glasses give a lingering note resembling that of a violin.

WHEN Benjamin Franklin paid his first visit to Europe he was astonished, at a public performance, when an Irishman produced unusually sweet music from several rows of drinking glasses. The musical glasses, in those days, were called a "Harmonica," and as soon as Franklin returned home he secured a set of the glasses and spent many days mastering them.

In the ordinary form, musical glasses

Scratching the scale mark on each glass simplifies tuning.

consist of thin goblets placed in rows on a table. Each row represents an octave of the musical scale, and each glass is "tuned" with water. That is, a glass filled with water nearly to the top will, when snapped with the finger-nail, sound a low pitch; and the less water in the glass, the higher the pitch, due to the lesser dampening of the vibrations. A finger moistened with lemon juice, or an alum solution, will give a sharp musical note when rubbed slightly on the rim of the glass. That is the principle on which the glasses operate.

Franklin made an improvement in the Harmonica by using sheets of glass, round in shape and continually revolved by a treadle. The outfit is more or less stationary, and cumbersome, however, and the quality of the tones cannot compare with those obtained with the method to be described. The New Musical Glasses can be prepared by anyone and but a few hours practice is necessary before you are ready to entertain.

Suitable glasses can be obtained for five or ten cents each at department stores. The thinnest ones should be selected. Eight are required for each octave, and three octaves are recommended, although many simple pieces of music can be played with one or two.

Place the glasses in rows of eight on a cloth-covered table, as illustrated. The cloth used is a sheet of sign cloth, on which each octave is lettered directly back of a circle to show the position of each glass.

By experimenting it will be found that rubbing a wet finger on the rim of one of the glasses, a high note will be sounded; particularly if the finger has been wet with lemon juice. Pouring water into the glasses will lower the pitch, exerting a dampening of the vibrations according to the amount of water used. Therefore, it will be found easy, by using the piano as a tuning instrument, to tune each glass to the correct note.

When all the glasses have been tuned and are in their correct positions on the

Glue the bows to hold the hairs in place.

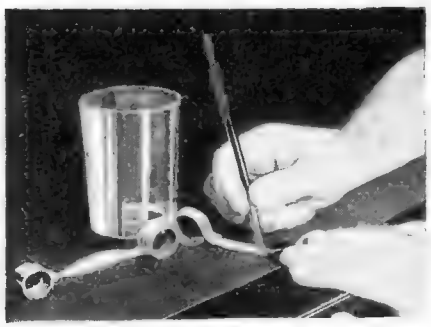
cloth chart, scratch on each the water height with a sharp pointed file so that each can in future be instantly tuned by filling with water to the mark.

Playing the glasses with the bare hands has been the method of the past. In the improved method, however, you make miniature "bows" which fasten to the finger and thumb of each hand.

These are constructed by purchasing some white hair as used for violin bows and winding it into 2½ inch long lengths on pieces of cardboard. Glue each end of each bow well to hold the hairs in place; then remove them from the cardboards, and attach to each "bow" two round bands which fit the thumb and first finger. When the glue is dry, brush on the hairs a solution of resin in alcohol and they are ready for use.

If you are not acquainted with music,

(*Continued on page* 479)



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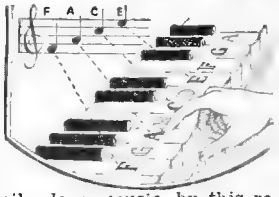

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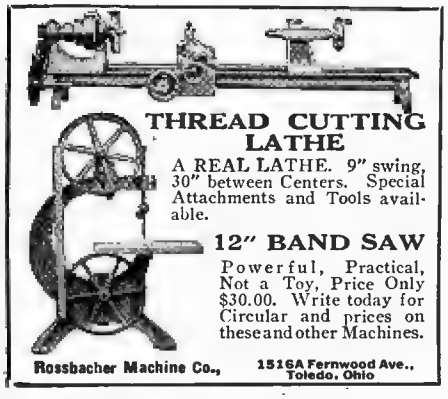

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Emergency Fuse Rack and Test Lamp

By Warren L. Crane

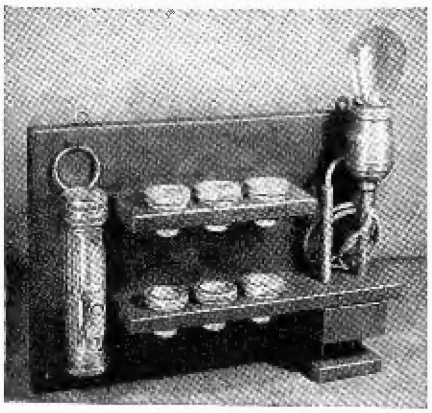
What happens when a fuse blows? Almost always this happens at night and leaves you in utter darkness! Then the question arises as to where and how to get a temporary light, find a new fuse and locate the fuse box. Why not think of all this in advance and make up a little rack, similar to the one illustrated, where these necessaries will be ready to hand when the need arises.

This rack holds a flashlight, a supply of spare fuses and convenient test lamp with which to locate the trouble.

The work involved is slight and the device will save much in the way of time and temper. The test lamp is the only item which may need detailed description, but may be made from materials found in almost any home workshop.

A standard lamp socket with ⅛" pipe thread containing a 10-watt bulb forms the handle. Into this is screwed the fibre tube from a 5-amp. 500-volt cartridge fuse (the brass caps having first been cut off and the tube cleaned out).

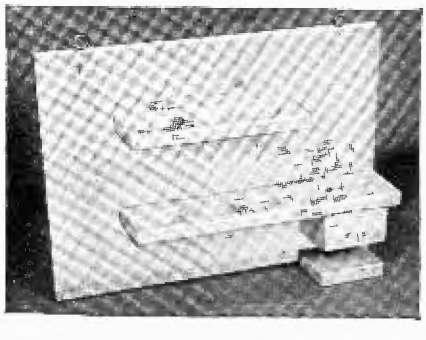
The tip carrying a brass terminal, is turned from a piece of fibre, vulcanite or even hard wood. An easy way to make this piece is to cut off a piece of stock the required length, drill a hole through it



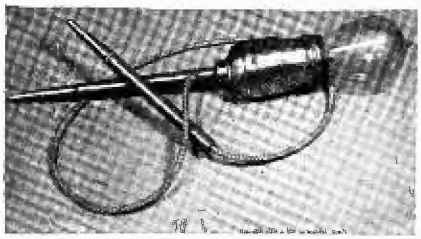
The fuse rack and test lamp outfit complete, with flashlight for emergency use.

slightly smaller than the diameter of the brass rod to be used as a contact. Cut off the rod so as to leave about ¼" extending beyond each end and mount in the lathe, using the ends as a mandrel for turning the piece to size and shape. The other terminal is made in a similar manner, but of course without the lamp socket. The ends may be cemented in place, but if the turning is carefully done the size may be made such that a tight press fit in the fibre tube can be obtained, which is all that is necessary.

In wiring, one tip connects to one terminal of the socket through the tube by means of a piece of fixture wire and the other terminal of the socket to the flexible lead through a hole in the side of the tube to the other contact, as shown in the illustration.



The rack is easily made and is hung upon the wall in a convenient location.



The test lamp complete with terminals.

Musical Glasses

(*Continued from page* 477)

you can readily learn to play the musical glasses by marking your sheet music notes with "a, b, c, d, e, f, g, a" (the octave) to correspond with the cloth chart under the glasses; or a musically inclined friend can mark the music for you.

Place the miniature bows on the fingers, as illustrated, and gently draw them across the edges of the glasses. An almost indescribable note will be heard; wailing, penetrating, and yet bearing a likeness to a note on the violin.

With the marked sheet music in front of you, and standing at the rear of the table, it will be found easy to pick out the notes and play them on the glasses; with but a little practice you will learn the position of each glass in relation to the note it

Draw the bow slowly across the edge of the glass.

produces, and be able to play any music from memory. Short, light touches of the bows to the glasses are suitable for light, fantastic pieces; drawing the bows slowly, so that each note is held several seconds, gives rich pipe-organ effects and a type of music entirely new and unusual. With development and practice, you may add the effect of tinkling bells by attaching to the little fingers wires with tiny metal balls on the ends, which are struck against the sides of the glasses lightly as you play with the bows.

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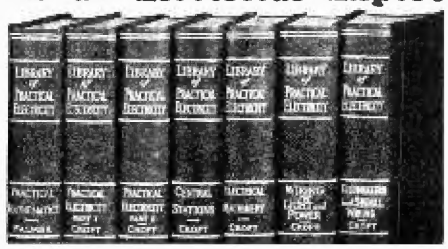

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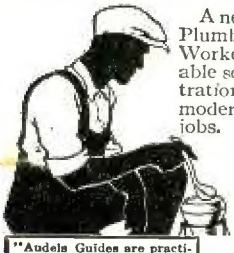

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